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INDEX.

THE MANUFACTURER AND BUILDER.

Vol. XIII.—No. 1. JANUARY, 1881. THIRTEENTH YEAR.

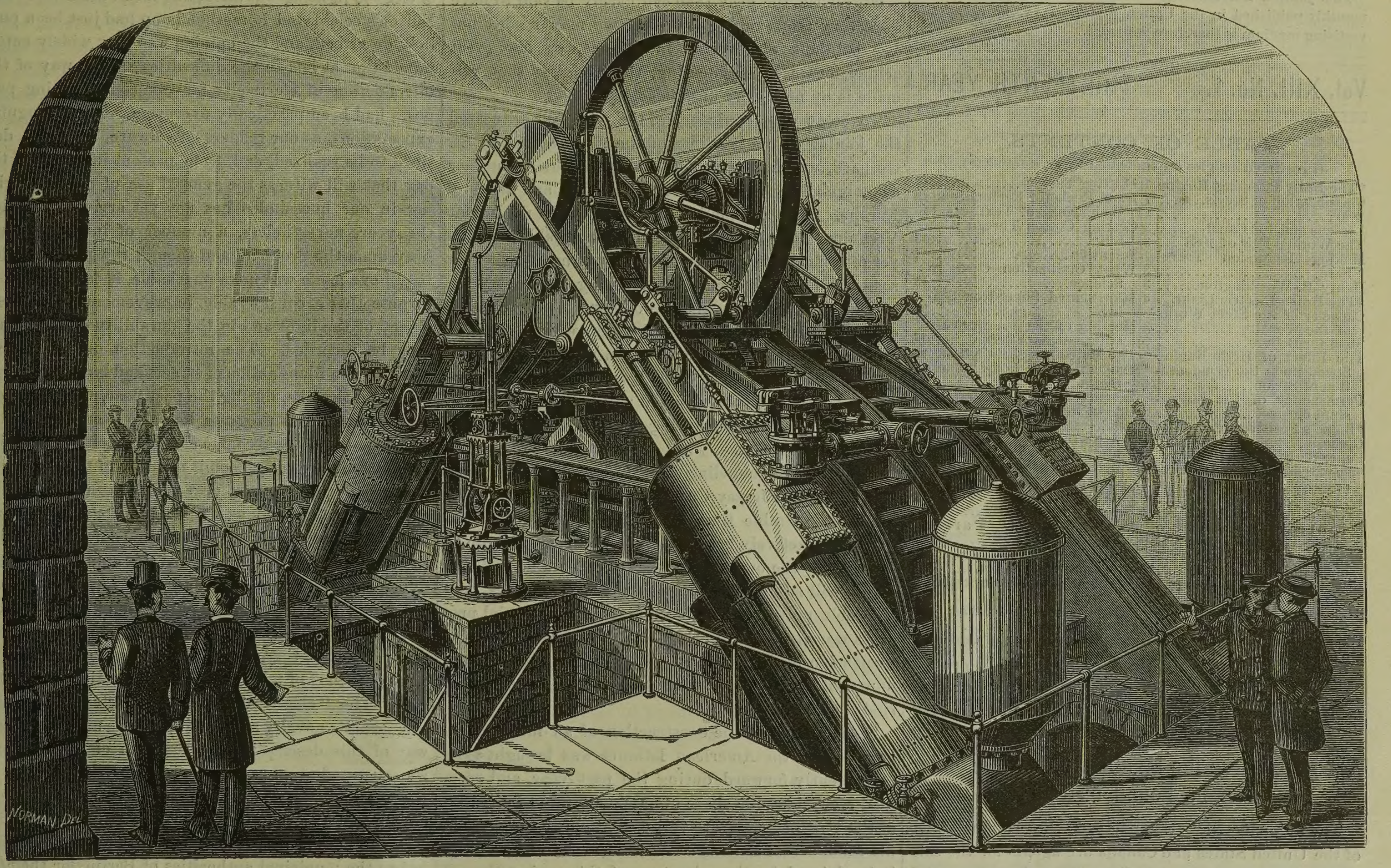
The Holly Pumping Engine at Buffalo, N. Y.

We present herewith an illustration of the Holly pumping engine employed at the Buffalo (N. Y.) water-works. As will be perceived, the engine is provided with four cylinders and four pumps. These cylinders and their pumps are arranged in pairs opposite to each other, upon supports of unusual strength, and the two cylinders of each pair are connected with each other. The connection of the pumps with the steam cylinders, and of the steam piston-rods with the pumps, is such that any one of the engines or pumps may readily be thrown out of action. The steam pistons are packed by means of cast-iron rings and springs, which can be adjusted without the necessity of opening the cylinder.

The valve mechanism of the steam cylinders is the ordinary slide valve, actuated by an eccentric. The engines are provided with a cut-off mechanism of peculiar character, by which the period of steam introduction may be completely varied from the instant of introduction to full stroke. The governor is likewise of special construction. The dimensions of this engine are as follows: Extreme length, 43 feet; hight, 26½ feet; breadth, 17 feet; the diameter of the steam cylinders is 25 inches, with 33 inches stroke; the pump cylinders are 15½ inches diameter, with 33 inches stroke.

The engine in question developed at a trial test a duty of 141.55 horse-power, but develops in ordinary use an average of 119.85 horse-power.

This engine was built by the Holly Pump Works, at Lockport, N. Y.



THE HOLLY PUMPING ENGINE AT BUFFALO, N. Y.

Classification of Steels.

The production of numerous special varieties of iron by the open-hearth and Bessemer processes, has rendered the older classification of steels practically useless, and has occasionally given considerable trouble to officials and others charged with the task of properly designating these products. The difficulty in question has not yet been satisfactorily overcome, though this is gradually being done. One of the leading steel works of Belgium (Sociètè Cockerill of Seraing) has adopted the following convenient method of classifying their products. They arrange their steels into four classes.

Class 1.—Extra mild steels, such as have carbon from 0.05 to 0.20 per cent, a tensile strength of 25 to 32 tons per square inch, and extension of 20 to 27 per cent in 8 inches of length. These steels weld, but do not temper. They are suitable for boiler, armor and girder plates, nails, wires, etc.

Class 2.—Weld steels, such as have carbon from 0.20 to 0.35 per cent, with a tensile strength of 32 to 38 tons per square inch, and extension from 15 to 20 per cent. These steels are difficult to weld, and can only be slightly hardened. They are suitable for railway axles, tires, rails, guns, and other uses where heavy strains are to be borne.

Class 3.—Hard steels, such as carry carbon from 0.35 to 0.50 per cent, with a tensile strength of 38 to 46 tons per square inch, and extension from 15 to 20 per cent. Such steels will not weld, but may be tempered. They are suitable for rails, special tires, springs, guide-bars of steam engines, pieces subject to friction, and the like.

Class 4.—Extra hard steels, such as carry carbon from 0.50 to 0.65 per cent, with a tensile strength of from 46 to 51 tons per square inch, and an extension of from 5 to 10 per cent. Such steels will not weld, but may be strongly tempered; and are adapted for delicate springs, files, saws, and cutting tools generally.

Iron in Utah.—Prof. Newberry, before a late meeting of the American Academy, read a paper giving a glowing account of the iron and coal deposits of Utah, and predicted a great future for that territory when they are developed.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 1. THIRTEENTH YEAR.

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Agencies where the Manufacturer and Builder can be Found on Sale.

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1880.

A number of favoring circumstances coincided to make the year through which we have just passed one of the most prosperous which this country has known for a long time. As the chief of them, in its direct influence, we must name the partial failure of the grain crops abroad, which for the second time in succession has coincided with abundant harvests on this side of the Atlantic, and made an eager market for the contents of our overflowing graneries. The vivifying influences of the rapid revival of the business of the country were felt in every direction. Mills, factories and workshops throughout the land, no longer idle, resounded with the busy din of industry; labor, skilled and unskilled, was in demand, with full time and good wages the rule; the railroads were taxed beyond all previous years to provide facilities for the transportation of merchandise, and their earnings were swelled to hitherto unprecedented figures. In short, all classes and conditions of our population participated in the general prosperity of the country.

Otherwise, the year 1880 can hardly be said to have been very remarkable; but while we may record but few brilliant discoveries in science, or few great achievements in engineering, the progress that was made is by no means unsatisfactory.

To begin with engineering, the past year witnessed the joining of the headings of the great tunnel of St. Gothard, which, when completed, will provide another commercial highway between the north and south of Europe. The completion of the railway up Mount Vesuvius, though not a specially remarkable work, is yet of sufficient interest to be worthy of mention. This road was formally opened early during the past year, and has proved exceedingly popular. The projectors of the tunnel under the English Channel were not idle, and during the past year continued the preliminary work upon which they have been engaged for some years, and which it is expected will shortly afford decisive information respecting the feasibility of this gigantic enterprise.

The work of tunneling the Hudson River between New York and Jersey City, which had been postponed for a considerable time by reason of legal complications, was actively begun during the year, and up to the time of the occurrence of the lamentable accident which will still be fresh in our readers' memories, considerable progress had been made. Substantial progress was also made during the year upon the great suspension bridge across the East River, and we may now confidently expect its completion at an early period.

The question of the construction of an interoceanic canal across the American Isthmus was brought very prominently forward during the past year, and occupied a considerable share of public attention by reason of the visit of Lesseps to this country in the interest of his canal across Panama. At the time of this writing, it is claimed by the advocates of this project that all the funds necessary for its undertaking have been secured by subscription, and that active operations will be at once begun upon it. A rival American company was likewise formed during the year to construct a canal across Nicaragua; and this project also attracted considerable notice from the prominence of those who are identified with it. What the final result will be respecting these undertakings time alone will show; it is not improbable, however, in view of the recent proclamation of the President and the expected action of Congress respecting the subject, that it will become of national interest.

Before dismissing the subject of interoceanic communication across the isthmus, another scheme looking to that end, and which was brought out during the past year, is worthy of mention. We refer to the proposal of Capt. Eads to construct a ship railway across the isthmus at Tehuantepec, on a scale of such magnitude that the largest steamers may be transferred upon it from ocean to ocean.

The successful demonstration of the capabilities of the Perkins system of using high-pressure steam in ocean navigation, which was made during the past year by the notable voyages of the little steamer "Anthracite," is worthy of special mention as being a substantial advance towards realizing greater economies in the use of steam.

In metallurgy no discovery of magnitude was reported during the past year, but the experience gained with the Thomas-Gilchrist process of dephosphorizing iron has been very valuable in demonstrating the fact that phosphoretic pig iron may be successfully used in the manufacture of steel by the Bessemer process. The importance of this process will be understood when it is remembered that until it was made known, only the very highest grades of pig iron could be successfully manipulated in the converter. When the capabilities of this process have been fully developed, it is confidently anticipated that the commonest grades of iron will answer for steel making. Its influence, therefore, on the future of the steel manufacture promises to be most beneficial.

At the commencement of the past year the question of electric lighting was attracting much attention. Mr. Edison's celebrated horseshoe lamp had just been publicly described, and the opinion was very widely entertained that at length the difficulties in the way of the introduction of electricity for domestic lighting purposes had been practically overcome. These sanguine expectations, as our readers are aware, were not destined to be realized, and, from present indications, the day that will witness the general use of electric lighting in our households has not yet arrived. During the year, nevertheless, a number of inventors were busy upon the problem, and though the progress that they have made was not remarkable, it is satisfactory to note that a considerable improvement in the efficiency of the light and in the durability of the lamps may be recorded. The introduction of the electric light for the illumination of streets and large buildings, mills and the like, during the past year, was very general. Substantial progress has also been made in the effectiveness of the dynamo-electric machine, in which connection we must not omit mention of the important fact that during the past year it has been successfully applied in telegraphy as a substitute for the galvanic battery hitherto universally employed for generating the electric current. We regard this application of the dynamo-electric machine as a highly important one.

Beyond the very general extension of the system of telephonic exchanges, which has now come quite generally into use, there is little to record in the improvement of the art of telephonic communication during the year. The "electrical railway" attracted some attention from its novelty and possible future utility. A railway of this description (on the plan of Dr. Siemens) was operated at an exhibition in progress last year in Berlin; and Mr. Edison subsequently made public a description of a plan of similar character. It is of interest to note in this connection that Dr. Siemens laid before the municipal authorities of Berlin, for their approval, a plan for an elevated electrical railway across that city, for the transfer of passengers and for postal service.

By far the most important scientific announcement of the past year, was that of the discovery by Messrs. Bell and Taintor of a practical method of employing a beam of light for the transmission of sound. This discovery was made public at the meeting of the American Association for the Advancement of Science, held at Boston, and attracted great attention in the scientific world by reason of its very novel and extraordinary character. The discoverers named the apparatus by which they succeeded in making this remarkable demonstration, the Photophone. The construction and action of this apparatus have been fully described in our columns.

In paying our final respects to the year 1880, we

have only to add that we hope we may be able to refer to the years that will succeed it in as cheerful and satisfied a spirit, for in the general prosperity the MANUFACTURER AND BUILDER has fairly participated. Its subscription list and advertising patronage both show substantial growth, and we begin the new year with prospects that never were brighter or more promising.

Lesseps and his Canal.

Some months ago we had occasion to refer to the probability that the government of the United States might be placed in an exceedingly awkward position by reason of the hesitating course hitherto pursued by Congress on the question of the building of an interoceanic canal across the American Isthmus. Since expressing that opinion, the probability has become a reality, and the government has been brought face to face with the necessity of either backing up "the policy of this country," as formulated by Mr. Hayes, of "a canal under American control," or of backing down from it, and consigning the famous "Monroe doctrine" to the limbo of forgotten traditions.

The enterprising Lesseps has been vigorously perfecting the organization of his company, and report has it that he has succeeded in raising by subscription all the funds required to insure the construction of his proposed canal at Panama. We may, therefore, safely assume that this energetic gentleman proposes to go right on with the work he has set his hand to, without even asking, What are you going to do about it? Being a man of affairs, and a diplomat as well as an engineer, he is doubtless fully alive to the importance of getting his work well under way as speedily as possible, for should he succeed in doing this before Congress takes action in the premises, his position will be immensely strengthened and that of our government very greatly, if not fatally embarrassed. So long as this undertaking has no existence except on paper, it is not too late for us to put a peremptory veto upon its construction, save and except under such conditions and terms as will protect our commercial and national interests; but once it is under way, the time for protests, resolutions and proclamations will have passed, and nothing short of actual forcible intervention will avail us anything. Now we have M. de Lesseps to deal with; then we shall have France, Great Britain, Spain and other nations whose citizens have put their money into the enterprise, and who will not call in vain upon their respective governments to protect their imperilled interests from destruction.

If, as the President has declared, it is the right and duty of the United States, for the protection of our national interests, to maintain a "supervision and authority over any interoceanic canal across the Isthmus that connects North and South America," then, in view of the present forward state of Lesseps' preparations, it is the urgent and imperative duty of Congress to take forthwith such action as shall clearly and unmistakably show him and his associates that the government of the United States will prevent a foreign company, acting under a foreign act of incorporation, from building an interoceanic canal across the American Isthmus. Such action should have been taken long ago, and it is disgraceful that a decisive expression of the intentions of the government on this vital subject should have been so long delayed.

Just previous to the adjournment of Congress, there were indications that the importance of prompt and determined action in this matter had begun to dawn upon the minds of some of the members of that august body, and the following resolution, introduced by Representative Crapo, of Massachusetts, was referred to the Committee on Foreign Relations:

"*Resolved*, That the construction of an interoceanic canal connecting the waters of the Atlantic and Pacific Oceans by means of foreign capital, under the auspices of or through a charter from any European government, is hostile to the established policy of the United States, and is in violation of the spirit and declaration of the Monroe doctrine, and cannot be sanctioned or assented to by the government; that the United States will assert and maintain such control and supervision over any interoceanic canal as may be necessary to protect its national interests and means of defense, unity and safety, and to advance the prosperity and augment the commerce of the Atlantic and Pacific States of the Union."

This declaration is sufficiently explicit, and unless emasculated by unnecessary delay in its passage, it will most probably have the effect of putting a perpetual injunction upon any further proceedings on the part of M. de Lesseps.

Henry R. Worthington.

Henry R. Worthington, whose death occurred since our last issue, was one of the most prominent and successful engineers in the country. Mr. Worthington achieved wealth and reputation by his important inventions and improvements in connection with hydraulic machinery, and his pumping engines are in use in many of the largest cities and towns in this country. Mr. Worthington was identified with several important manufacturing enterprises, and always manifested great interest in everything pertaining to the promotion of the mechanic arts. One of his latest acts was to participate as one of the founders of the American Society of Mechanical Engineers. Mr. Worthington died on his 63d birthday.

The World's Fair of 1883.

The recent action of the Executive Committee of the projected exhibition of 1883, in all human probability definitely settles the question that the exhibition will be held. The greatest difficulty encountered by those having charge of this important enterprise, has been to secure a site suitable for the requirements of a great exhibition—a difficulty which will be best appreciated by those of our readers who are familiar with New York and its environs. The appropriation of a portion of Central Park for exhibition purposes, which was at first mooted as being most suitable and available for the purpose, aroused a very decided popular opposition, which the committee wisely respected. In seeking for another location, however, so much diversity of opinion developed itself, that it appeared at one time as though the project would have to be postponed for a time, an alternative which was rapidly making itself felt by reason of the fact that so much time had already been fruitlessly consumed, and the period fixed for the holding of the exhibition was rapidly drawing near. These difficulties appear to have culminated at a recent meeting of the Executive Committee, at which a recommendation from the Law Committee was presented, urging, in view of the foregoing facts, that the committee should take steps to secure such additional legislation as would be necessary to permit of a postponement of the period of opening the exhibition until June, 1885.

This recommendation the Executive Committee is reported to have promptly and decidedly voted down, an action which will go a great way towards restoring public confidence in the ultimate success of the undertaking, which the previous dubious and hesitating course of the commission had seriously impaired. The action of the Executive Committee is decisive notice to the public that they are confident of the ability of the commission having the work in hand to complete within the time specified by the law as it now stands all the preparations that may be necessary to open the exhibition in 1883.

At the time that this is written, it appears almost certain that the commission will decide to hold the exhibition at Inwood, the sub-committee appointed to examine its merits having made the following very favorable report concerning it:

"It is what is more familiarly known as the Parade Ground, having at one time been selected by the Park Commissioners and Gen. Shaler for that purpose. It extends from Dyckman street to 211th street, and lies between Sherman avenue and Harlem River. It contains about 250 acres, which are level or gently undulating. It is served with gas and Croton water. It is thought by competent authorities to be easily accessible by railroad and river transportation. It is eleven miles from the City Hall, and is not yet reached by the elevated railroads, but undoubtedly will be should the exhibition be held on it. Three roads are already projected to a point near the proposed grounds. The drives to the ground are very broad and beautiful. The use of the site is offered free of all expense to the commission. Altogether, Inwood possesses very many advantages as a site for the exhibition."

Now that the Executive Committee has placed itself on record as determining that the exhibition shall be held at the appointed time, and also that a suitable site for the buildings has been found, it only requires that the work still remaining to be done shall be energetically attacked, to insure the hearty coöperation of business men and manufacturers throughout the country. There is no reason why the World's Fair of 1883 should not be made a great success.

Making Excursion Travel Safe.

Since our last issue, our attention has been called to the organization, by a number of wealthy capitalists, of a company for the purpose of creating and operating a fleet of passenger steamboats to accommodate the excursion traffic on our bays, rivers and other inland waters, which, especially in the neighborhood of New York, has grown to enormous proportions, and is constantly on the increase. It is further proposed—and this is the important feature that most interests us—that these boats shall be constructed wholly of iron and steel, and each is to be divided into not less than twelve water-tight compartments, thus making them thoroughly fire-proof and practically safe against the danger of foundering in case of being disabled by collision or otherwise.

The company which has been organized, proposes, it is reported, to build a fleet of thirty such vessels, of the best material, provided with improved machinery, electric lights, and every approved form of apparatus and fittings to insure comfort, speed and safety. Eight or more of these boats, it is said, will be constructed at once, so as to be ready for next summer's use.

The desirability of some such improvement as that proposed, in the character of excursion boats, is abundantly demonstrated by the appalling loss of life and destruction of property on the waters about New York alone, during the past summer, by fire and collision. These disasters have shown the necessity of substituting for this rapidly growing traffic iron steamers—strong, seaworthy and fire-proof—in place of the very inferior and dangerous wooden vessels in use up to the present time.

We trust, in view of the events of the past summer, that the announcement of the intentions of the iron steamboat company is correct. The necessity for boats of the character contemplated is urgent, and there is no reasonable doubt but that their introduction would prove immensely popular with the traveling public, and correspondingly profitable to their owners. The movement once started, we have also little doubt, would inaugurate the speedy substitution of iron steamboats for those of wood on all our inland waters.

An Effective Practical Joke.

In a recent experimental test of the Westinghouse air-brake on a Brazilian railroad, some practical joker, without the knowledge of the engine-driver, had placed on the track, in advance of the train, an excellent imitation of a huge mass of rock, made of painted pasteboard. The obstruction was not discovered until the engine was close upon it; but the driver succeeded, nevertheless, in stopping his train within a few feet of it. The joke was rather trying to the nerves of the driver, but afforded the best possible demonstration of the value of the brake. The Emperor, Dom Pedro, it is narrated, was a passenger on the train to witness the experiments, and, it is hinted, was cognizant of the trick.

The Brush Electric Light.

It is becoming more and more apparent as the months pass by, that the recently awakened enthusiasm respecting the general introduction of the electric light is destined to be realized, and that this time the electric light has come to stay. Since the earlier attempts at utilizing electricity for illumination, some twenty-five or thirty years ago, which resulted in the failure to achieve practically successful results, and in the general impression that it was at best a superb but expensive luxury, which was probably destined to remain such for an indefinite period, we have immensely improved upon the methods of generating electricity. The troublesome, uncertain and expensive chemical battery has been supplanted by steam-driven induction machines which afford an immeasurably superior source of electricity than the former, and are adapted to all the requirements of science and the useful arts. Since the announcement of the earliest machines of this class, they have attracted the attention of scientific men, and have undergone material improvement at the hands of Brush, Wilde, Gramme, Siemens, Edison, Maxim, and Houston & Thomson.

With the improvements in the machines for supplying the electric current, we have had corresponding improvements in the methods of utilizing the electricity, and to-day we have two distinct systems of electric illumination—the voltaic arc and the incandescent, contending for public favor. The last named system is the outgrowth of the attempt to practically substitute gas lighting for domestic purposes, and involves the successful solution of the difficult problem of indefinitely subdividing the electric current without serious loss of power. This problem has thus far baffled the skill of inventors.

The other system contemplates the illumination of large areas by powerful lights, and has of late been so far perfected as to have achieved a pronounced success for the lighting of public thoroughfares, harbors, bridges, public buildings, hotels, mills, factories, and the like. In this connection the Brush electric lighting system, by reason of the extent to which it has been introduced, and the favor with which it has been received, has come to be recognized in this country as the representative of the system which it illustrates.

Up to the first of July last, we are informed, there were no less than 3,000 Brush lights in use, and since that time their number has been increased to over 4,000. As an evidence of the superiority of the methods employed for utilizing the current, the advocates of the Brush system point to the fact that the machine about to be described, is capable of maintaining from 10 to 18 electric lamps, each of a nominal power of 2,000 candles, on one circuit, with the consumption of about 14 horse-power, a performance which, it is claimed, greatly surpasses anything that has thus far been achieved by any other system in use.

This subject at the present time has acquired special importance from the fact that within the past month a company has received the necessary concessions for the purpose, from the municipal officers, and has been engaged in introducing the Brush system of electric illumination in New York city for lighting the streets. The company in question has already located its first station, and has put down its initial plant at 133 and 135 West 25th street. The territory contracted by the company embraces the area from 14th (Union Square) to 34th streets, and from Third to Eighth avenues; and they have already introduced their system in practice upon Broadway between 14th and 34th streets, within which limits they have erected 22 lamps, each giving, it is said, a light of 2,000 candles. These lamps are mounted upon iron posts of ornamental design, and 25 feet high. Thus far, we are informed, this experiment has given very general satisfaction, and we have every reason to believe that we shall soon witness the extension of the system throughout the city on the large scale contemplated by the movers in this enterprise.

A brief description of the details of this important public work may not be without interest. The power is supplied by a Corliss engine of 100 horse-power, built by Messrs. Watts, Campbell & Co. The foundations have been laid for a second engine of the same dimensions, but thus far only one is in place. The boilers used are of the horizontal tubular pattern, and are 16 feet long by $5\frac{1}{2}$ feet in diameter, the upper half of the shell being of iron and the lower half of steel. Each boiler has 92 tubes, of 3 inches diameter. Two circuits will be connected with this station, which, when in full operation, will be supplied by five of the Brush dynamo-electric machines. One of these circuits will be used exclusively for public lighting, and the other will supply the wants of private parties for hotels, stores and the like.

The plant has been devised with the view of accomplishing every possible economy in the generation and consumption of power. An interesting feature in this connection is the setting of the boilers with the Jarvis system, which has achieved a very favorable reputation for effecting a decided saving in the consumption of fuel, and which also permits of the use of inferior or refuse combustible material to an extent not possible under ordinary circumstances. In the case we are considering, it is intended to use as fuel a mixture of about 10 parts of coal-dust to 1 of bituminous coal. The element of economy claimed to be introduced by the employment of this invention is important enough to warrant a brief account of its details.

The object of Mr. Jarvis in his system of boiler-setting is to utilize the heat which is ordinarily wasted in a furnace, by compelling it to perform the useful work of heating the air required to effect the more complete combustion of the fuel, and the gases evolved during combustion. To accomplish this, he utilizes the bridge-wall and the back of the furnace, as well as the side walls, for the heating of the air to be discharged into the combustion chamber, for which purpose suitable channels or passages in the side walls are provided as conduits. The entering air, therefore, is delivered to the column of gases arising from the fuel at a high temperature, thereby avoiding the usual loss of heat by the introduction of cold air, bringing the combustible gases into contact at a temperature more closely approximating to the temperature of combustion; and, by the manner in which it is distributed, effecting a more intimate intermixture of the air and combustible gases, and consequently insuring a more perfect combustion and greater heating effect beneath the boiler. That this construction yields excellent results in practice on the score of economy, has been amply demonstrated, and its adoption with the boilers of the Brush company is an evidence that its merits are properly appreciated.

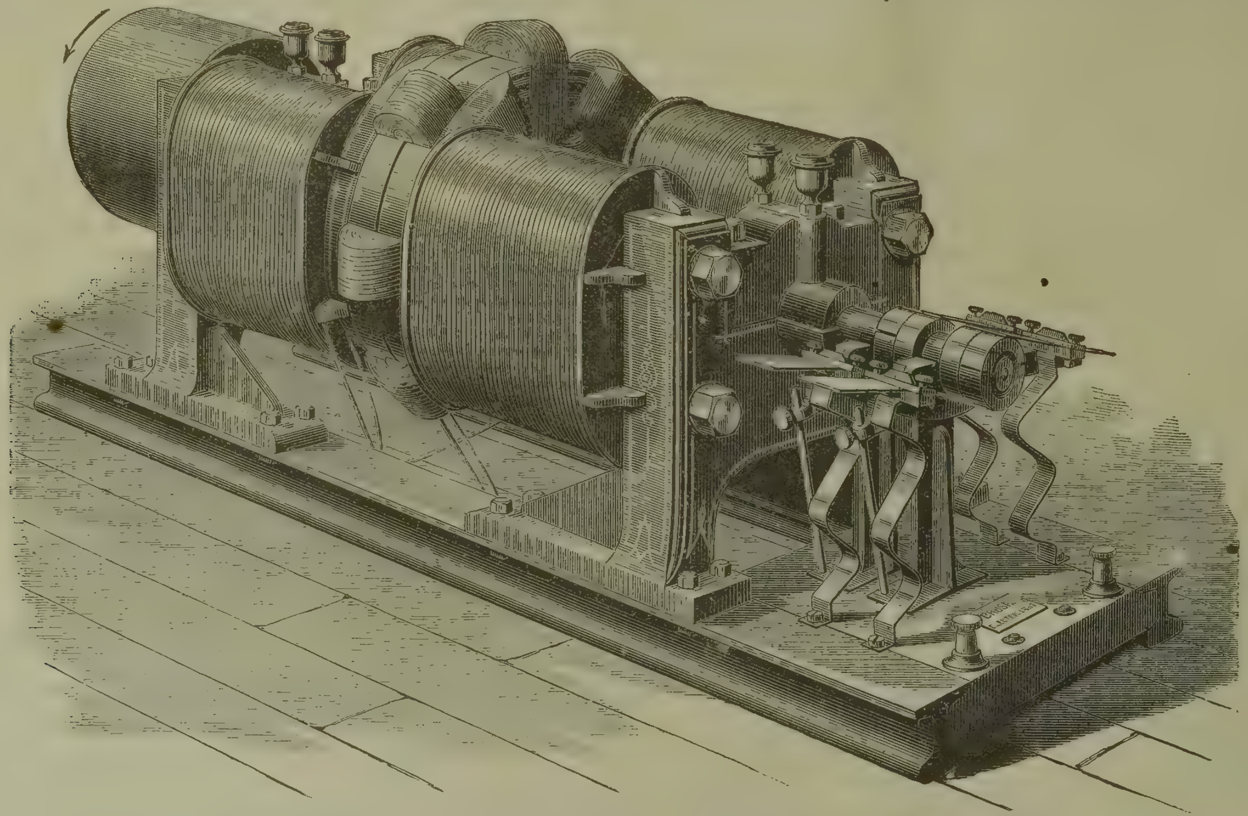


Fig. 1.—THE BRUSH IMPROVED DYNAMO-ELECTRIC MACHINE.

To return now to the electrical machinery. Fig. 1 represents the appearance of the Brush dynamo-electric machine employed. It is 68 inches in length, 30 inches in width, 30 inches in hight, and weighs 2,500 pounds. It is driven at a speed of from 750 to 800 revolutions per minute. Fig. 2 represents the various forms of lamps used by the Brush company. In this cut No. 1 shows a double lamp, provided with two carbon rods, side by side, so arranged that when one set has been

consumed, the other is thrown into the circuit automatically without interruption of the light. These lamps will burn for sixteen hours without requiring attention. No. 2 represents a bundle of carbons ready to be used, showing the manner in which they are packed for shipment. No. 3 shows the single lamp ordinarily used, and which is capable of running without attention for 7 or 8 hours. These lamps are run without clock-work or similar mechanism, being provided with a magnetic regulator, which in turn is called into play by the current, and automatically regulates the distance between the carbons and preserves the uniformity of the lights. The carbons themselves are made with the greatest care, with the view of preserving a perfect homogeneity of texture. No. 4 represents a focussing lamp, intended for use with the stereopticon and for lecture-room purposes. No. 5 shows a form of head-light lamp to be used on locomotives or steamships, with reflectors. No. 6 is a regulating switch or dial attachment, intended for use with the large machines, and is arranged so that any number of lights from one up to the full number may be burned without varying the speed of the machine. No. 7 shows an ornamental lamp adapted for use in hotels, stores and other places where a more showy lamp is needed. It can be made either single or double, as desired.

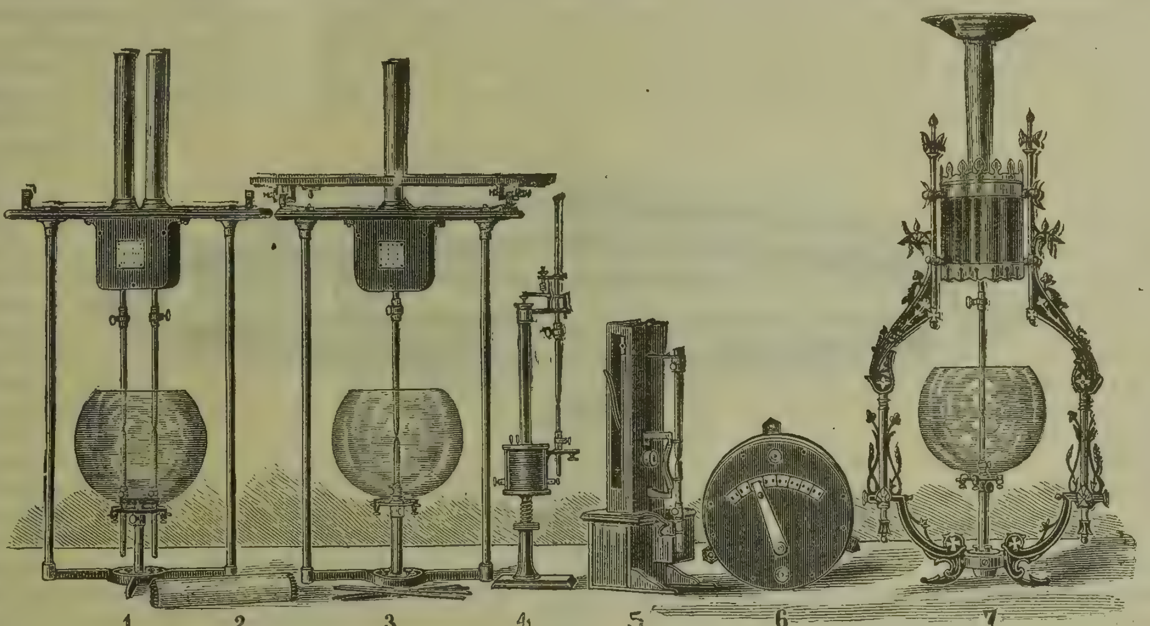


Fig. 2.—THE BRUSH IMPROVED ELECTRIC LAMPS AND FIXTURES.

Tested by the gauge of practice, the Brush electric lighting system has certainly achieved a very remarkable and creditable success, and the latest and most ambitious of its public applications to which we have alluded, will be watched with particular interest, since its triumph would insure the wide extension of the plan of lighting by electricity in our cities and towns. That the experiment now being made will be successful we sincerely hope, and have every reason to believe, since it has already proved successful where similarly employed. In Montreal, Ont., for example, where it has for some time been in use, one Brush machine works a circuit of 14,600 feet, or nearly 2¾ miles in length, along the wharves for illuminating the harbor.

The details of operating the Brush system of lighting seem to have been worked out to a high state of perfection. Its representatives assert that with the latest machine they have constructed, which is known as the No. 8 Machine, they are enabled, with the expenditure of 34 horse-power, to maintain 40 lamps, each giving a light of 2,000 candles, a performance which, it may be safely asserted, has not been hitherto equalled.

Of the general merits of the electric light on the score of safety, brilliancy and purity of color, we need add nothing, since our readers are already sufficiently familiar with the facts. To these desirable qualities we may now add that of cheapness, and have little hesitation in making the assertion that it will speedily come into general use for the illumination of large buildings and areas, and for public streets, parks, etc., for which it is preeminently adapted.

In conclusion, we add the names of a few of the establishments in which the Brush electric light has been introduced, most of which will be recognized by our readers as among the most prominent in the country, viz., the North Chicago Rolling Mill Co., the Union Rolling Mill Co., Chicago; Park, Bro. & Co., Black Diamond Steel Works, Pittsburgh, Pa.; Brown, Bonnell & Co.'s mills, Youngstown, O.; Washburn & Moen M'f'g Co., wire mills, Worcester, Mass.; Niles Tool Works, Hamilton, O.; Otis Iron and Steel Co., Cleveland, O.; Passaic Rolling Mill Co., Paterson, N. J.; Bay State Iron Co., South Boston, Mass.; M. C. Bullock, Diamond Drill Works, Chicago; Riverside Worsted Mills, Providence, R. I.; Amoskeag M'f'g Co., Manchester, N. H.; Willimantic Linen Co., Willimantic, Conn.; Grand Pacific Hotel, Chicago; to which might be added the names of some thousands of others, which we have not space to mention.

We regard the experiment now in progress in New York as of the highest importance in its bearing upon the general introduction of public lighting by electricity. We shall watch the progress of the experiment carefully, and will take pleasure from time to time in publishing the results of our observations.

Should our readers desire special information respecting the Brush system, they can obtain all needful facts by addressing the Brush Electric Light Company, 860 Broadway, New York.

The Capacity of the Steel Works of the World at the present time is figured at about 3,000,000 tons per year. The Bessemer works of the United Kingdom, with 120 converters, contribute to this total from 750,000 to 800,000 tons; the United States, with probably half as many converters, but much superior plant and management, produce 750,000 tons or more. Germany has lately increased her capacity for steel production, and at present can produce about 500,000. France produces 275,000; Belgium, 150,000; Austria, 250,000; and Sweden and Russia about 150,000 tons.

Steel for Boilers.

The failure of the steel boilers of the Russian steam yacht "Livadia," has furnished the English technical journals the text for an extended discussion of the merits and demerits of this material for the purpose named. One of the foremost of these, the London *Engineer*, has arrived at the conclusion that English experience has shown that, with the exception of the plate manufactured by two firms, which it names, steel is unfit for the purpose; and it condemns Bessemer steel *in toto* for boiler plate, giving preference to that made by the open-hearth process. The *American Manufacturer*, in a criticism of these conclusions, makes some interesting comparisons between English and American experience in the use of steel for boilers. Our Pittsburgh contemporary expresses surprise at the condemnation of boiler-plate steel, affirming that no such condemnation could be pronounced on the same product made in this country. There are, it alleges, four firms in Pittsburgh alone making steel boiler plate, all of whose products give "uniformly excellent" results. The same journal asserts that the steel boiler plate trade in this country is steadily growing, to the great detriment of the makers of iron boiler plate, and that three-fourths of the marine boilers and of the locomotive fire-boxes made in and around Pittsburgh are at present made of steel.

The Effect of High Engine Speed upon the Condensation of Steam.

At a recent meeting of the Master Mechanics' Association, Mr. C. A. Smith, of St. Louis, reported the results of a series of experiments made to ascertain the temperature of steam cylinders during the working of the engine at varying speeds. The apparatus employed in these experiments consisted of a silver tube 6 ins. long, $^5/_{16}$ of an inch in diameter outside, and $^1/_{32}$ of an inch thick, this tube being closed at one end, and having passed through it a rod connected by a cam and tooth gear to the index of an ordinary pressure gauge, the arrangement being such that the expansion and contraction of the silver tube moved the index of the gauge, and so indicated the temperature. The necessary graduations were obtained by a comparison of the instrument with a good thermometer. In using the apparatus, it was applied to the cylinder so that the exterior of the silver was exposed to the steam in the cylinder, and when thus applied to the cylinder of an engine working slowly, the index of the instrument showed, during each stroke, nearly the whole range of temperature to be expected from the variation in the pressure of the steam. At higher speeds, however, the range of action of the index became less. Thus the apparatus was applied to a locomotive hauling a light passenger train, the steam being throttled except at the highest speed. The experiments were continued through a run of 33 miles, and it was found that whereas when the engine was making but 50 revolutions per minute, the instrument indicated a change of temperature of 120° during each stroke; at 100 revolutions per minute the variation dropped to 60°; at 200 revolutions, to 30°; and at 300 revolutions, to 20°, the amount of variation being thus inversely proportional to the speed.

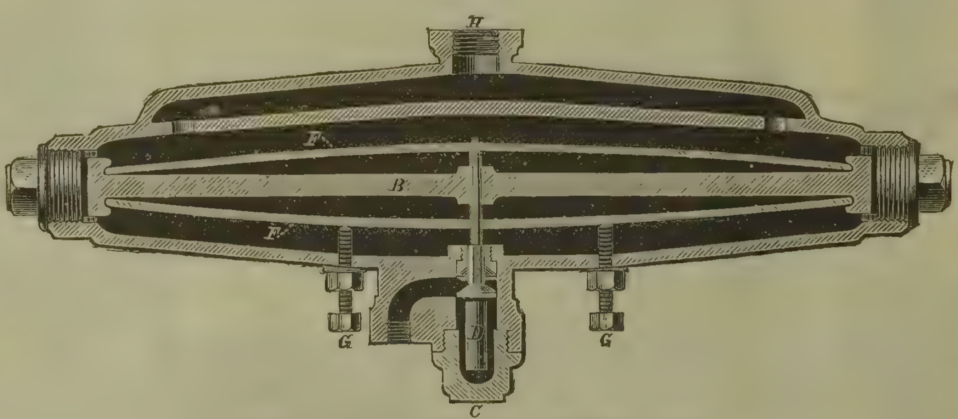
Permanency of the Mississippi Jetties.—In a recent discussion before the National Academy, the fact was brought out that the Gulf Stream, so called, does not come from the Gulf, as is represented in the physical geographies, but is an equatorial current which comes through the Caribbean Sea from the African coast, is turned northeast upon striking the coast of Yucatan, passes through the Straits of Yucatan and Florida, and out into the Atlantic, without really entering the Gulf of Mexico at all. The currents in the Gulf are not connected with this great stream, and are very slow. The mouths of the Mississippi have already projected so far beyond the general coast line as to have nearly reached the precipitous declivities of the deep Gulf basin, so there is no danger that the channel will ever be stopped again, or that the jetty system will have to be extended further into the Gulf than at present.

Blake's Positive Steam Trap.

The trap shown in the accompanying sectional engraving, is claimed by its manufacturers to be cheap and reliable. Its construction is very simple, and will be understood by the following description. Referring to the engraving, F F represent two brass leaves or buckling springs, by the expansion and contraction of which the trap is caused to operate; B is a casting which holds the springs in position; C is the valve-cap; D, the valve stem; G G are set-screws by which the springs are properly adjusted when the trap is put together; and H is the inlet.

The advantages claimed for this apparatus are the following: It has a much larger opening than a float trap, which may readily be seen, as it does not open against the pressure of steam, in consequence of which it will drain more pipe. It is always ready for operation, working equally well under high or low pressures. It is readily attached, and entails no additional expense for fittings. It is adjusted when made, and all its parts are made in duplicate. From its peculiar construction, its manufacturers assert that it will do more work, and do it better, than any other device intended for the same purpose. The trap is positive in its action, which is claimed to be a very desirable quality. It can be thoroughly cleaned in a few minutes without disconnecting the trap.

This trap is made of four sizes: No. 1, length, 17 inches; hight, 6 inches; thickness, 2½ inches. No. 2, length, 2 feet; hight, 9½ inches; thickness, 3 inches. No. 3, length, 2 feet 3 inches; hight, 10½ inches; thickness, 3½ inches. No. 4, length, 2 feet 3 inches; hight, 11½ inches; thickness, 3½ ins. No. 1 trap, according to the makers' directions, may be connected with 2,000 feet of 1-inch pipe, No. 2 with 3,500 feet, No. 3 with 5,000 feet, and No. 4 with 7,000 feet.



THE BLAKE POSITIVE STEAM TRAP.

The Blake trap, to sum up the advantages claimed for it, automatically removes water from steam pipes without permitting the escape of steam. It can be applied with great advantage where steam is used for heating or drying purposes, where it insures a much greater and more uniform heat. It prevents the disagreeable cracking noise so familiar to users of steam-heaters, and is an effective protection against the freezing and bursting of steam pipes. Every trap is carefully tested before it leaves the works.

The makers are the Salamander Grate Bar Co., of 110 Liberty street, this city, who may be addressed for further information.

Glucose.

The recent disclosures of the immense profits realized by manufacturers of glucose, which were made public in the course of a recent suit brought for the purpose of determining the ownership of certain shares of the Buffalo Grape Sugar Company, have very naturally been given wide publicity, and have excited considerable public interest and curiosity to learn something about a business that pays 160 per cent per annum upon the capital invested in it, as the evidence in the case went to prove.

The glucose industry has grown up in this country within the past fifteen years, and from small beginnings has increased until it has assumed immense proportions. From the best evidence we have respecting it, there are at present ten glucose factories in this country, running day and night, consuming 21,000 bushels of corn per day, each bushel yielding on an average 28 pounds of glucose. These figures would indicate a yearly production of over 200,000,000 pounds. Of this product, five-sixths is syrup, or glucose, (as the manfacturers term it), and one-sixth grape sugar. That the business is an immensely profitable one, would appear to be proved by the fact that those engaged in the manufacture are very reticent concerning it, and incidentally by the fact that the business has, at least, doubled every year for the last five years. Large quantities of the products of the glucose factories are now exported to Europe, our manufactories being able to furnish a cheaper and very superior article to that made abroad from potatoes.

The principal object of the originators of this industry in the United States we are informed, was to manufacture syrup, and from this the applications of the products have widely extended. The glucose syrup is not so sweet as cane syrup, but has a lighter color, and when mixed with the latter it improves its color, though the saccharine strength or sweetness is impaired. The use of glucose for this purpose has come to be very general, and though even at the present time the business is largely conducted in a surreptitious manner, there are some manufacturers who do not hesitate to openly acknowledge that they employ glucose in their syrups, and to defend its use for that purpose.

The glucose is likewise largely used by brewers, distillers, and vinegar makers; for sizing paper, for making printers' inking rollers, and for other uses. The grape sugar, under which term the manufacturers designate the solid portion of their product, is known to have been for some years quite largely used by confectioners, brewers and others. Now, however, it is added in the proportion of from 12 to 20 per cent to cane sugar, and in this form the mixture is brought into the market under the name of "New Process Sugar." As in the case of the corn syrup, the addition of corn sugar to cane sugars distinctly improves the color of the latter, while it decidedly reduces its sweetness, which is of course the real test of the value of either a syrup or a sugar. By these explanations it will have been made apparent that color, which has hitherto been regarded as one of the indicators of the quality of saccharine products, can no longer be so regarded.

The enormous growth of the business of making syrup and sugar from corn has awakened the very natural suspicion that these products are extensively used for adulterating cane syrups and sugars, and sold for the latter; and there is little doubt but that this species of falsification is carried on, though to what extent it is impossible at present to say. The sale of such mixed products for cane sugar products is just as much a fraud upon the public as the sale of oleomargarine for genuine butter. As is the case with oleomargarine, corn sugar and syrups are not unwholesome; on the contrary, we think they may be looked upon as quite as wholesome as cane sugar and syrup. The fraud comes in where the corn products, which are cheaper and of less saccharine strength, are palmed off upon the public for what they are not.

It is now universally admitted that oleomargarine is a useful and wholesome product, and the great opposition which it at first met with was no doubt owing to the fact that unscrupulous dealers sold it under the false representation that it was butter. This species of fraud has been corrected by requiring dealers, under penalty, to stamp their suet-butter with its proper name, and to sell it as such, that the public may know precisely what they are buying.

The same species of legislation will no doubt be called for very soon respecting the sale of sugars and syrups mixed with corn products. There is nothing objectionable about them on the score of wholesomeness, as above remarked, but the public should not be subjected to the risk of being defrauded by having a cheap and inferior article palmed off upon them for another from which it cannot readily be distinguished. We strongly suspect that the adulteration of cane syrups and sugars is becoming very general. In the case of syrups the fact is very generally admitted, but with regard to sugars the public are as yet uninformed. That the practice is rapidly extending is made reasonably certain by the stand lately taken by some of the leading sugar refiners and dealers in cautioning the public against this form of adulteration. One of these protests we give below:

"By a recent invention, starch or corn sugar (more generally known as grape sugar), heretofore quite extensively used by confectioners, brewers, etc., has been made sufficiently dry and white so that it can be powdered and mixed with yellow sugars. It raises the standard of color largely, but, not being so sweet, reduces the saccharine strength. Large quantities of these sugars are now being made and sold under various brands, but all of them, so far as we are aware, bear the words 'New Process' in addition to the other brands. Believing that consumers buy sugar for its sweetening properties, we shall not handle these goods unless compelled to. . . This invention brings a new element into the sugar business, and buyers can no longer rely upon color as an indication of value."

The passage of some such law as that in force respecting the traffic in oleomargarine, would, we think, be eminently proper in respect to the sale of corn sugar products. It would impose no unnecessary restrictions upon what has grown to be an immense business, while it would amply protect the public against the cupidity of unscrupulous dealers.

We have not deemed it necessary here to go into the process of manufacturing corn sugar products, being interested simply in the industrial and commercial side of the case. Our readers, however, who may wish information on these points, will find numerous articles respecting the process of manufacture in the back numbers of this journal.

Paper Barrels from the Pulp.

We have on a former occasion alluded in this journal to the manufacture in Boston of paper boxes direct from the pulp, by special machinery, and are now informed, on the authority of a well written article in the Detroit *Tribune*, that paper barrels are being made from the pulp after the method of a Western inventor, and that the product bids fair to become an important article of commerce. The material, in the course of manufacture, is subjected to a pressure of 400 tons. The body of the barrel is of one piece, and made of coarse wood pulp. The heads are likewise of one piece, and made in the same way. When the parts are put together, the completed barrel is said to be very light, strong and durable, and to have the additional advantage of cheapness.

Two kinds of these barrels are said to be made; one for fruit, flour, and other dry substances, and another for lard, oils and liquids generally. A barrel of this

kind filled with flour, may, it is said, be dropped to the pavement without injury. Fruits packed in these receptacles are said to keep better and longer than when put up in the usual way, as they are kept perfectly dry and hermetically sealed from the atmosphere. The paper barrels are reported to be 50 per cent cheaper than the usual wooden ones.

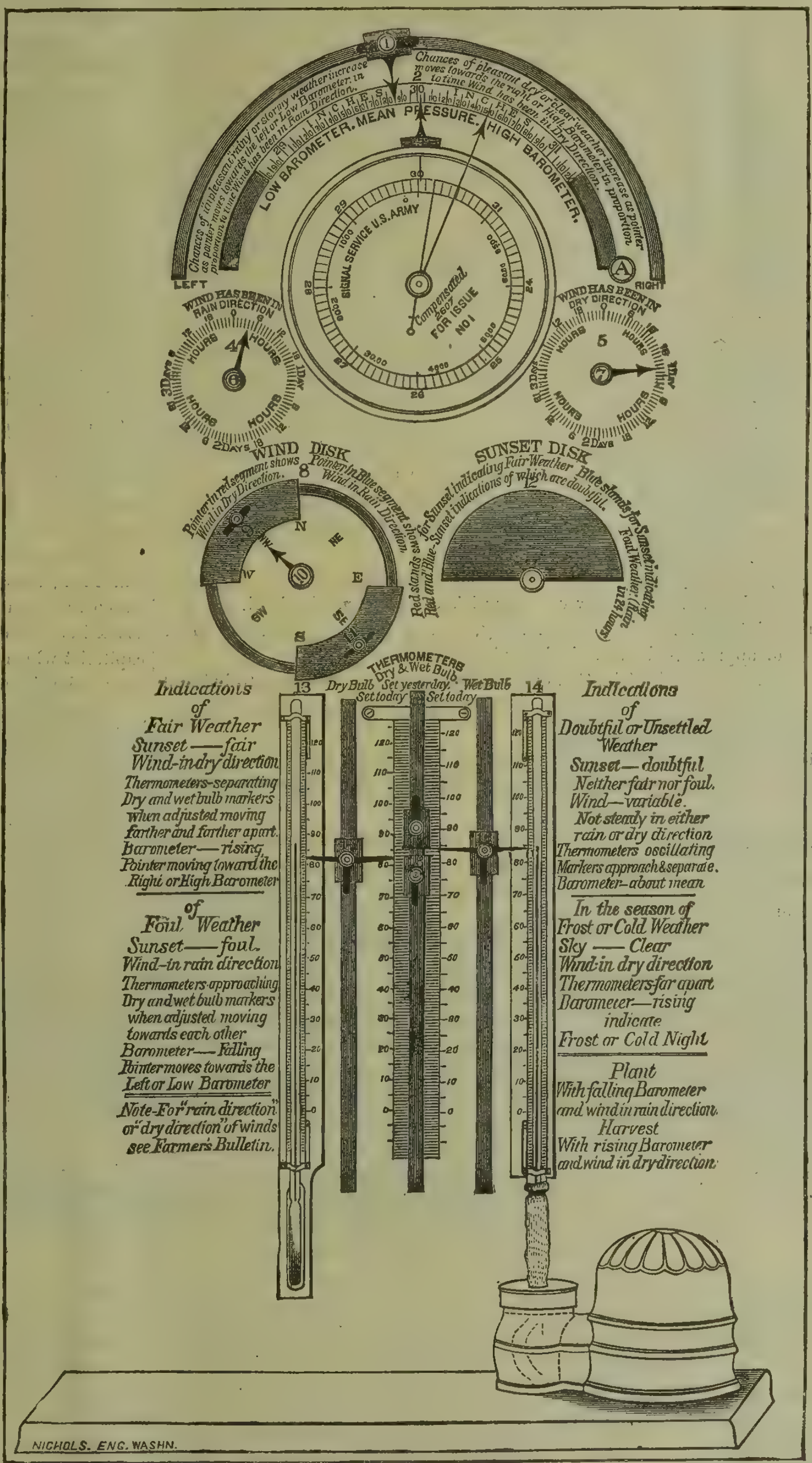
The Signal Service "Weather Case."

The apparatus shown in the accompanying engraving represents a compact form of "weather case," designed by the late Gen. Myer, chief signal officer, to be located at rural post-offices, and generally at places off the lines of frequent travel and telegraphic communication, and is intended to give to farmers and others a more satisfactory means of forecasting the weather than they now possess. This apparatus comprises a barometer, wet and dry bulb thermometers, wind and sunset disks, and the indications are interpreted by a set of simple and intelligible explanations, from which the weather probabilities for twenty-four hours in advance may be gleaned with considerable accuracy.

A glance at the illustration of the apparatus, in connection with the official description which we append, will enable our readers to appreciate its practical value to those who intelligently read and use it. The pointer or index at the top of the case (No. 1), slides on the brass arc; it is known as the "sunset barometer index," and indicates, when set, by the figures to which it points on the "main barometer scale," which is just below it, the reading of the barometer at the time of the sunset yesterday. The "main barometer scale" (No. 2) exhibits all the barometric readings likely to be used with this instrument. The pointer (No. 3) just below the "main barometer scale," is called the "reference index," and indicates by the figures to which it points on the main barometer scale, when the instrument is set, the mean or average reading of the barometer at the *place* at which the instrument is set and for each separate *month*. When the barometer reads above or below this reading at any place, such reading is said to be "above the mean" or "below the mean," for that place in that month. This reference index is established in the exact central line of the face of the case. The long brass hand over the glass face of the barometer is known as the "long pointer," and indicates, by the figures of the "main barometer scale" to which it points when set, the reading of the barometer when last set. The black pointer on the face of the barometer under the glass face is known as the "short pointer," and indicates the existing pressure of the atmosphere at any time the instrument may be examined.

There are for each place and each month two kinds of winds: First, winds which, blowing from certain directions, are at that place and in that month more likely than other winds to be followed by rain. These are called "rain winds. Second, winds which, blowing from certain directions, are at that place and in that month less likely than other winds to be followed by rain. These are called "dry winds." The wind direction for any day or time must be seen and taken at each place or station by a vane as well located as practicable. The "wind disk" (No. 8) consists of a brass circle, on which slide freely two arcs—a red arc, called the "dry wind arc" No. 9), and a blue arc, called the "rain wind arc" No. 11). In the center of the disk is a pointer turning with a turning-screw, and called the "wind disk pointer" (No. 10). Around the disk are letters to show directions, as N. for north, E. for east, NE. for northeast, etc. The pointer and scale (No. 5) on the right of and below the barometer, are called the "dry-wind time record," and the pointer (No. 7) is called the "record pointer," and indicates, when set, the length of time the wind has been blowing continuously from a "dry" direction, by the figures showing the number of hours on the scale to which it points.

The pointer and scale (No. 4) on the left of and below the barometer, are called the "rain-wind time record," and the record pointer (No. 6) indicates, when set, the length of time the wind has been blowing continuously from a "rain" direction, by the figures showing the number of hours on the scale to which it points. The record pointer on the rain-wind time record (No. 6) is always turned by the thumb-screw, and set pointing at the figure 0 on the scale when the wind is not blowing in the rain-wind direction. In the same way, the "record pointer" on the dry-wind time record (No. 7), is always set pointing at the figure 0 when the wind is not blowing in the dry direction.



THE SIGNAL SERVICE "WEATHER CASE."

The sunset disk (No. 12) consists of a circular disk, one-half of which is colored red and the other half of which is colored blue. The disk turns upon a central turning-screw in such a manner that half of the disk shows through a semicircular opening in the face of the weather case. The sunset disk is set as follows: At the exact time of every sunset, the western sky and the character of the sunset is carefully observed. The examination ought to be minute and careful, lasting for about fifteen minutes. If the sunset sky is clear or red, or markedly what is known as a "fair weather sunset"—a sunset such as is generally held to indicate a clear or fair day to follow on the next day—a day on which it will not rain—the sunset disk is turned by the turning-screw until the semicircular opening shows all red. The sunset disk, thus turned, is described as set for a "fair weather sunset."

If the sunset sky (the western) is cloudy or foul, or markedly what is known as a "foul weather sunset," a sunset such as is generally held to indicate foul weather to follow on the next day—a day on which it will rain—the sunset disk is turned by the turning-screw until the semicircular opening shows all blue. The sunset disk thus turned is described as set for a "foul weather sunset." If the appearance of the western sky and the character of the sunset are neither markedly those of a "fair weather sunset," or of a "foul weather sunset," but such as to leave the observer in doubt how to style it, the sunset disk is turned to show half red and half blue, or "doubtful." The sunset disk, thus set, is described as set for a "doubtful weather sunset."

In the lower part of the weather case there are two thermometers, a dry-bulb thermometer (No. 13) on the left-hand side of the case, and a wet-bulb thermometer (No. 14) on the right-hand side. The dry-bulb thermometer is like any other thermometer, and shows by its readings the temperature of the air. The wet-bulb thermometer is one, the bulb of which is kept constantly moist by the water passing up from the glass reservoir, through the wicking which covers the thermometer bulb. The readings of the dry-bulb thermometer and those of the wet-bulb thermometer are more and more unlike, or farther and farther "*apart*," as it is called, in proportion as the air contains less and less moisture—that is, is becoming *drier*. The readings of the dry-bulb thermometer, and those of the wet-bulb thermometer, become more and more *alike*—are nearer and nearer together—in proportion as the air contains more and more *moisture*; that is, is becoming saturated or *wet*.

By the side of the dry-bulb thermometer (No. 13), is the dry-bulb pointer, which slides on the brass slide (No. 15). By the side of the wet-bulb thermometer is

the wet-bulb pointer which slides on the brass slide (No. 16). In the center of the case is the "dry and wet bulb scale," marked on the paper on which is the central brass slide bar (No. 19), and on this slide move the dry-bulb keeper (No. 17) and the wet-bulb keeper (No. 18). To set the thermometers examine first the dry-bulb thermometer and move the dry-bulb pointer (No 15) on the slide until the outside point is exactly level with the top of the mercury in the thermometers —as near to it as practicable. Examine next the wet-bulb thermometer, and move the wet-bulb pointer (No. 16) on the slide until the outside pointer is exactly level with the top of the mercury in the wet-bulb thermometer, or as near to it as practicable, then turn to the dry and wet bulb scale, and on the "central brass slide bar" (No. 19) move one of the keepers until it touches as nearly as possible—is on an exact level with the inside pointer of the "dry-bulb pointer;" then move the other deeper until it touches, as nearly as practicable—is on an exact level with the inside pointer of the "wet-bulb pointer." The thermometers are now set and the difference between their readings can be known by counting on the "dry and wet bulb" scale the number of degrees between the keepers.

When the thermometers are examined and set again, following the same plan, it will be easily seen whether the "keepers" are, when set, nearer together than at the previous setting.

If they are farther apart, the thermometers are said to be "separating;" if they are nearer together, the thermometers are said to be "approaching." Other things being equal, the thermometers show, when they are "separating," that the air is becoming more dry, one sign of approaching fair weather. The thermometers show, when they are "approaching," that the air is becoming more moist or damp, one sign of approaching rain.

The weather case is not intended to be used independently of the official weather reports, but in connection with them, supplementing the official reports by showing the local instrumental indications and giving other information.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

NEW YORK CITY BUILDING ITEMS.

Eugene Kelley is to have built on the site of the old Clinton Hotel, on Beekman and Nassau streets, an office building nine stories high.

J. B. Shook, architect, has prepared plans and specifications for strengthening the foundations and walls of the Madison Square Garden, and for other improvements; to cost about $20,000.

At Nos. 344 and 346 West Fifty-Seventh street, a six-story Ohio stone apartment house is to be erected. The dimensions will be 43 x 80 feet, and the cost $55,-000; owner, Ed. C. Coggeshall; architect, C. W. Romeyn.

A new house of worship for the Roman Catholic Church of St. John the Evangelist, is to be erected at the northwest corner of First Ave. and Fifty-fifth St. It will be of brick with a brick front, the dimensions being 78 feet front by 125 feet in depth. The plans were drawn by Arthur Crook, and the estimated cost is $70,000.

A large store is to be erected by James McCreery on the south side of East Fourteenth street, at Nos. 22, 24 and 26, now occupied by the Arlington Building. It will extend through to Thirteenth street, and will be five stories high. Its ground dimensions will be 75 feet front by 206½ feet in depth. The material will be brick, with an iron front. The estimated cost is $75,000. D. & J. Jardine are the architects.

Fulton Market is to be rebuilt, and $80,000 has just been appropriated by the city for that purpose. As the market now stands, it is erected on two double walls, which run parallel, on three sides of the market, on Beekman, Front, and Fulton streets. On the South street or river side there never has been any wall. These walls are to be torn down. The cellars, grogshops, etc., are all to be filled up. New walls 31 feet apart are to be erected. The central portion is to be made perfectly secure, but for the present the internal arrangement will not be disturbed. As the market exists to-day, you have to mount a series of dirty wooden stairs to approach the center of the building, which stairs you have to descend again. With the new plan there will be a continuous ground floor and no stairs. The greatest care will be taken as to drainage, and every possible convenience will be presented for the washing or flushing of the floor. There will be plugs of water at proper distances. There will be a truss roof over the new portion. The floor will be two-inch-thick yellow pine, laid in tar and caulked. There will be three entrances on Front street, with one on Beekman and one on Fulton. The South street front, between the two wings of the market, will remain as it is now, open. On each corner of Front street the building will rise above the level of the roof. For ventilation there will be ample provision by means of spacious windows. It is proposed that the demolition will begin some time from the 1st to the 15th of April, and the new building, it is expected, will be entirely finished and ready for market purposes by the middle of August. In regard to the central portions, they will in time, perhaps not later than 1882, be reconstructed in harmony with the rest of the building.

MISCELLANEOUS.

A new county jail is to be built at Bath, N. Y.

A cotton factory, to cost about $350,000, is to be built at Jacksonville, Florida.

The California Sugar Refinery are about to build at San Francisco what will probably be the largest refinery in the world.

The Unitarians at Ann Arbor, Mich, are going to build a new church, and $10,000 have been raised for the purpose.

The Pratt & Whitney Company of Hartford, Conn., have voted to build an extension to their factory, 44 by 48 feet, and three stories high. The excavating has already begun.

W. W. Carr & Co. are preparing to build a sash, door and blind factory, etc., at Dubuque, Iowa. The main building will be 80x140 feet, three stories high, frame; the engine, boiler and shaving room, 31x67 feet, two stories high, of brick; and a planing mill, 24x30 feet, one story high, frame. F. D. Hyde, architect, of that city, is preparing the plans.

The annual report of the Building Department of Brooklyn shows that during October, 1880, there were 69 more permits granted for erecting new buildings than for any year since 1873, and that as a rule the buildings are much superior to those that have been put up in former years. The buildings in greatest demand are the two-story and basement dwellings. The total number of plans for new buildings for the year is 903, embracing 1633 buildings, divided partly as follows: Private dwellings, 751; dwellings, more than one family, 264; stores and dwellings, 144; tenements, 25; shops, 69; factories and foundries, 62; churches, 5; storehouses, 20. The total number to be built of brick is 1,082, of which 523 are brown stone fronts, and of frame 551, at an estimated cost of $6,415,804. Seven hundred and sixty-eight brick houses and 554 frame houses have been completed, 464 are now being built. The greatest number in one ward is 197, in the Twenty-second Ward, 174 of these being brick. The Twenty-first Ward puts up 168, of which 105 are frame; the Eighteenth Ward 181, of which 100 are frame. The only other Wards exceeding 100 are the Seventh Ward, 116, of which 100 are brick. The Nineteenth Ward, 121, of which 107 are brick, and the Twenty-third Ward, 109, of which 107 are brick. The wards showing the smallest number of buildings were the Fifth, with 1 brick building, and the Fourth with 7 brick buildings. The alterations of buildings foot up 859, of which 839 were approved, and 813 completed. The total estimated cost is $685,581. Of violation of the building laws, 310 have been reported; 22 were for building without permission.

PROPERTY VALUES IN NEW YORK CITY.

Along with the study of the progress of building, it is interesting to occasionally take a retrospective view of real estate values in this city. At a sale held in 1849 the southwest corner of Broadway and Fifty-fourth St. was sold for $1,025, the two adjoining lots for $735 each, the next for $710, the one adjoining for $620, and the two following respectively for $690 and $800, the Fifty-third street corner being disposed for $1,180. The last corner was the northwest corner of Broadway and Fifty-third street. The northeast corner of Eighth Avenue and West Fifty-third street was then and there sold for $1,125, the adjoining four lots fronting on Eighth Avenue for $845 each, until they reached within seventy-feet of the corner of Fifty-fourth street. Then they dropped off to $775 each, the southeast corner of Eighth Avenue and Fifty-fourth street being sold at $1,000. In fact, the entire block, containing twenty-eight lots, was disposed of at an average of $500 for each lot, calculating the values of the twelve additional lots on Fifty-third and Fifty-fourth streets. We need not point our readers to the significance of the above figures, compared as they easily can be to the values prevailing to-day. Broadway fronts on said block are worth at least $18,000, and, thirty years have hardly passed since the above sale was effected. Gen. Egbert L. Viele says when he first began to lay out the Central Park, an entire block at Sixty-fourth street, between Fifth and Madison avenues was offered to him at six hundred dollars per lot. He tried in vain to get a capitalist who had plenty of money to see it in the same light as he did, but he did not, and declined to purchase it. Since that time one single lot in this identical block has sold for $50,000, and the entire block averages to-day fully $30,000 for each lot.

ENGLISH RULES FOR BUILDING.

The following rules for the construction of buildings have been prepared and published by the Secretary to the British Office of Works: 1. All water closets shall be constructed so that one wall at least shall be an outer wall of the building. 2. All soil pipes shall be carried outside the building and ventilated by means of pipes leading the foul gases above the highest point of the building, such pipes to be carried to points removed from the chimney stacks. 3. Separate cisterns shall be constructed for the water-closets and for the general purposes of the building. No traps or "draw-offs" shall be affixed to any pipe communicating with a cistern supplying a water-closet. 4. All water-pipes or overflow pipes of cisterns shall terminate in the open air, and be cut off from all communication with drains. 5. Great attention shall be paid to insuring thorough ventilation in all rooms. Rooms so high that their ceilings shall be more than two feet above the top of the windows, corridors, staircases and other open spaces, shall be specially ventilated, so as to prevent the accumulation of stagnant air. 6. All main drains should, when practicable, be formed outside the building. In the event of its being necessary to carry a main drain underneath a building, it must first be trapped immediately outside the main wall, and a ventilating pipe must be carried from that point to the highest part of the roof, as described under rule 2.

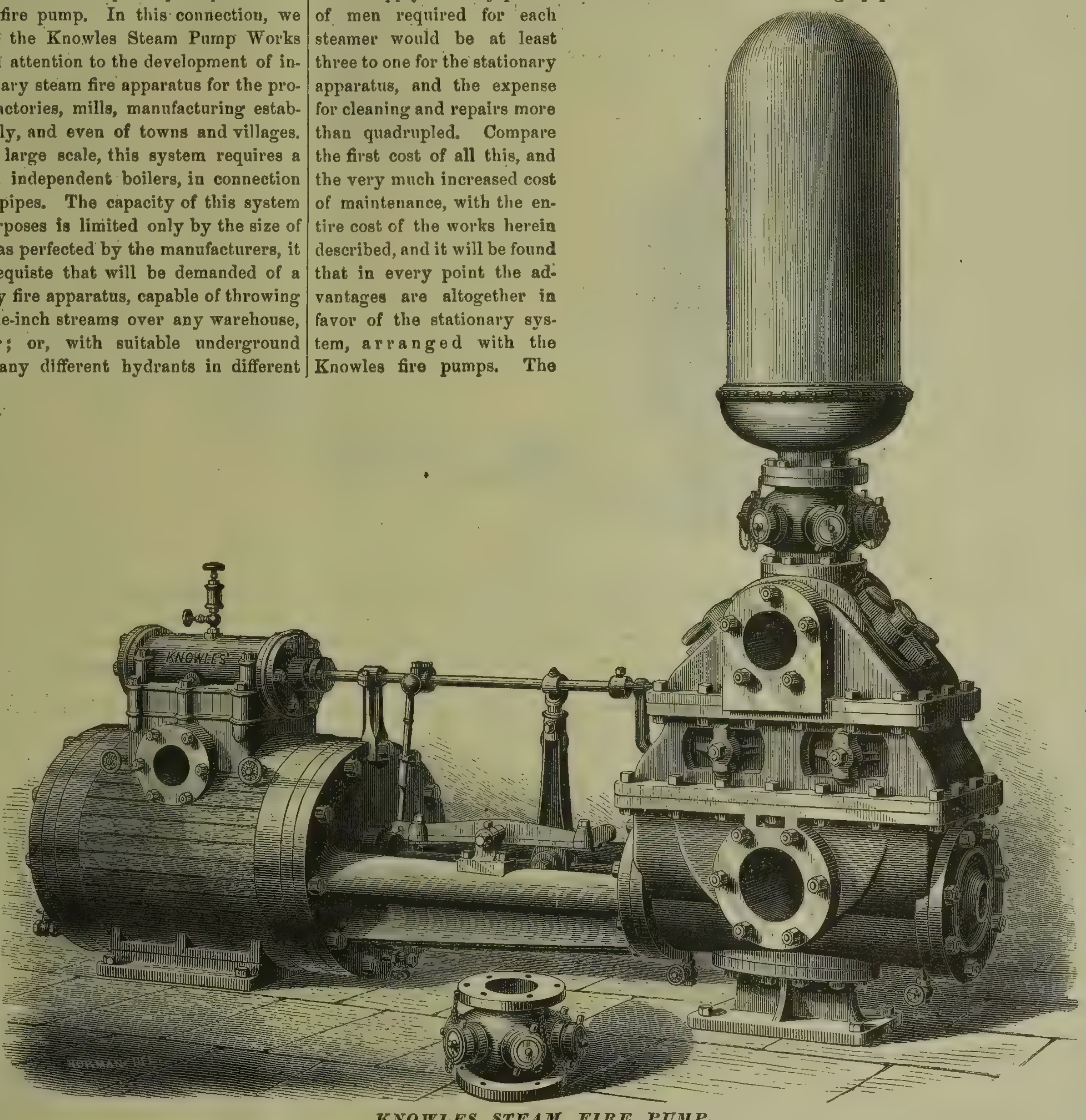
BUILDING VALUES IN LONDON.

In 1871, the gross value of buildings in London was $120,000,000. Within the five years following it had increased by a sum just short of $20,000,000. The third valuation for the decennial period is now completed, though some returns have still to be sent in. It is expected that these returns will raise the gross value to upwards of $165,000,000. In other words, the total increase during the ten years will amount to nearly $45,000,000, or something like 30 per cent.

Steam Fire Pumps.

From former notices of the special forms of steam pumps manufactured by the Knowles Steam Pump Works, which have from time to time appeared in the columns of this journal, our readers are no doubt familiar with the general features of their construction, which have caused them to be looked upon as typical representatives of the direct-acting, positive-motion steam pump. Our references, therefore, to the form of pump illustrated in the annexed engraving will be confined to those features which specially adapt it for its specific use as a fire pump. In this connection, we may remark that the Knowles Steam Pump Works have given special attention to the development of independent, stationary steam fire apparatus for the protection of large factories, mills, manufacturing establishments generally, and even of towns and villages. As erected on the large scale, this system requires a steam pump with independent boilers, in connection with a system of pipes. The capacity of this system for protective purposes is limited only by the size of the machine, and as perfected by the manufacturers, it combines every requiste that will be demanded of a superior stationary fire apparatus, capable of throwing from one to ten one-inch streams over any warehouse, factory or tower; or, with suitable underground pipes, from as many different hydrants in different parts of a town or village, thus affording as complete protection from the ravages of fire as water can give, at a fraction of the cost of steamers and their appliances.

The economy of this system for the protection of extensive manufacturing establishments, or of entire towns, is worthy of more general consideration than it has thus far received. A noteworthy illustration of its application is afforded by the town of Bristol, R. I., of which we append a brief account. The pumping station is a brick building 30 x 32 feet. Water is taken direct from the bay. The pump is a "Knowles Patent," with 22-inch steam cylinder, 12-inch water cylinder, 24-inch stroke, and boiler of ample size, made expressly for this work, and perfectly safe at 500 pounds pressure. There is now laid 12,000 feet of 10, 8, 6 and 4 inch pipe, with 12 gates and 42 hydrants. The trial test was made March 15, 1876, there being present the Chief Engineers of the Providence and Pawtucket Fire Departments, and many other invited guests. The fire was lighted under the boiler at 11.10 A.M.; two minutes thereafter there was five pounds of steam; in 2.40, ten pounds; in 3.15, fifteen pounds; in 4 minutes, thirty pounds; in 4.45, forty pounds; in 5.05, fifty pounds; in 6.20, ninety pounds, and the pump was started. Under the directions of the Fire Department, hose (50-foot lengths) was attached to the hydrants at the highest point in the town, being 42 feet above the station. Water was forced through 3,500 feet of pipe, and eight streams—four of them being 1-inch streams and four 1½-inch streams—were thrown, during a strong wind, 125 feet high, the pump maintaining 125 pounds water pressure, with 80 pounds of steam, the boiler blowing off steam throughout the entire test. The entire cost to the town was $23,000, including $1,000 paid for land for the station. Only one man is required to manage the works. To throw the same number of streams, with the same pressure, would require four first-class steamers. For each of these would be needed an engine-house and stable (not less than 25 x 100 feet), horses, harness, coal wagon, etc. In addition to this, provision must be made with tanks or otherwise for water supply in every part of the town. The number of men required for each steamer would be at least three to one for the stationary apparatus, and the expense for cleaning and repairs more than quadrupled. Compare the first cost of all this, and the very much increased cost of maintenance, with the entire cost of the works herein described, and it will be found that in every point the advantages are altogether in favor of the stationary system, arranged with the Knowles fire pumps. The assessed valuation of the property protected by this system at Bristol, is $4,000,000. Before its introduction, the town had one first-class steamer and several hand engines, and yet the test trial and subsequent ones have proved so satisfactory, that insurance companies are now re-writing policies at a reduction of more than 25 per cent from previous rates.



KNOWLES STEAM FIRE PUMP.

The special fire pumps of these manufacturers are made of all sizes, suitable for the wants of large and small establishments. One of these smaller forms of apparatus is shown in our engraving. The diameter of the steam cylinder is 24 inches; diameter of water cylinder, 12 inches; stroke, 24 inches; gallons of water per stroke, 11.75; strokes per minute, 1 to 175; capacity at full speed, about 2,000 gallons per minute. This pump is of the double-cap pattern, with six-way hose connection attached. The ports and valve openings are very direct and ample. It is provided with a recently patented compensating steam valve-chest, by which arrangement the valve-driving piston is enclosed in a gun-metal case, thus preventing any adherence by corrosion or expansion, and insuring instant starting under any and all circumstances. Pistons, rods, valve-seats, stuffing-boxes, and linings of water cylinders are of gun-metal (government standard).

The valves can be reached instantly above and below by the loosening of one nut on either side of the water chest. There are suction and discharge openings on both sides of the pump, and in addition to the regular discharge outlets, two, four, or six way hose connections are furnished as desired. Every pump is thoroughly proved at the works before delivery, and guaranteed.

The Knowles Steam Pump Works make a specialty of steam fire pumps, and have them in use in cotton, woolen and other mills and manufacturing establishments all over the country.

Further information respecting these pumps will be furnished on application to the Knowles Steam Pump Works, 86 Liberty street, New York.

Bessemer.

In spite of all that may be said of the advance of civilization, it is nevertheless true that the great majority of mankind, not excepting from the category the most enlightened peoples, are hero-worshippers—ever more ready to yield their homage to titles and brass buttons than to sterling worth.

No better illustration of this fact need be offered than was conveyed in recent newspaper accounts, that the city of London had conferred the "freedom of the city" upon Henry Bessemer, on whom "Her Most Gracious Majesty, the Queen," had lately conferred the honor of knighthood.

It may be asserted without fear of contradiction, that no man now living has conferred such signal benefits upon the world, and especially upon England, as the recipient of these tardily offered compliments. The newspapers refer to the "high honors" conferred on the distinguished inventor. We think otherwise; Bessemer dignifies these empty honors by accepting them.

Superiority of American Locks.—From a very exhaustive and able "Report on the Lighting, Heating and Ventilation of School Buildings in Great Britain, the Continent of Europe, and America," made to the government of New South Wales, by Sir Edward Combes, C. M. G., M. P., we quote (page 30): "American locks are much better than the common English

ones, as the bolt is made with a rolling instead of a sliding motion." As this report is by far the ablest and most practical contribution to educational literature which we have met for some time, and its author a most eminent engineer and statesman, the compliment to American manufacturers is peculiarly grateful.

Explosion of an Upright Tubular Boiler.

In continuation of our history of steam boiler explosions, we illustrate this month from the record of the Hartford Steam Boiler Inspection and Insurance Co., the case of an upright tubular boiler, of very good construction, which presents certain points of interest, as will be perceived from the following account.

No portion of the tubes in this boiler were uncovered by water on their convex surfaces when the water was at the gauge-cock level. The upper tube plate was placed below the summit of the boiler and flanged to a cylindrical uptake or smoke connection, similar to the furnace shown at the left hand of Fig. 1. Another important difference was the staying of these inner cylindrical portions to the shell by means of screw stays, the riveted ends of which are partly seen on the exterior, and the two rows belonging to the furnace are partly seen in the cavity from which the furnace plates were torn. It is obvious that this furnace is much better able to resist a pressure on its convex surface than one of the same dimensions not supported with stays, and they are justly more popular with inspectors. It appears, however, that they are not always so strong as to do away with the necessity of examination.

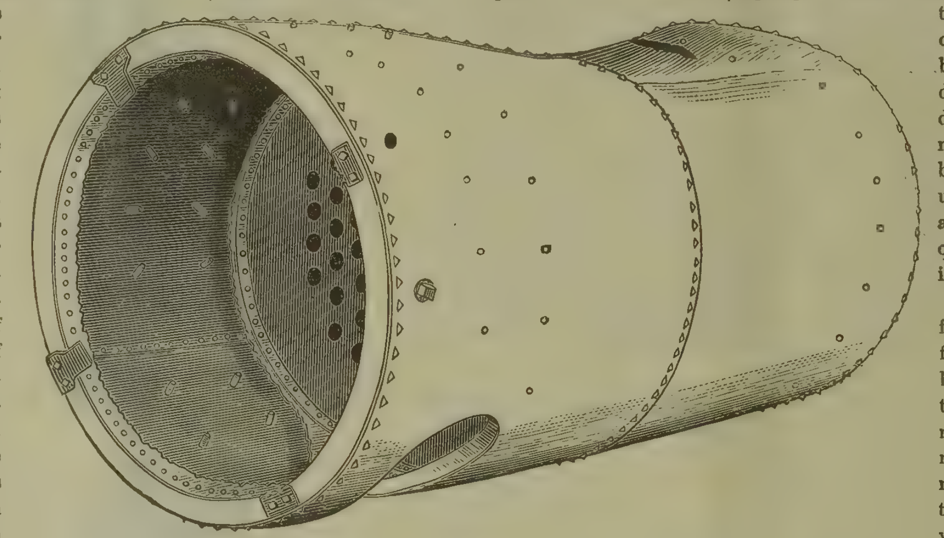


Fig. 1.

This boiler was an old one that had been some time out of use until about eighteen months before the date of the explosion, when it was repaired and put to work as an auxiliary for summer uses. The repairs consisted mainly of a patch in the furnace, near the door. It exploded by a collapse of the furnace, October, 1879, rising a distance of 100 feet in the air at such an angle from the perpendicular as to cause it to strike the ground some 150 feet from its working site.

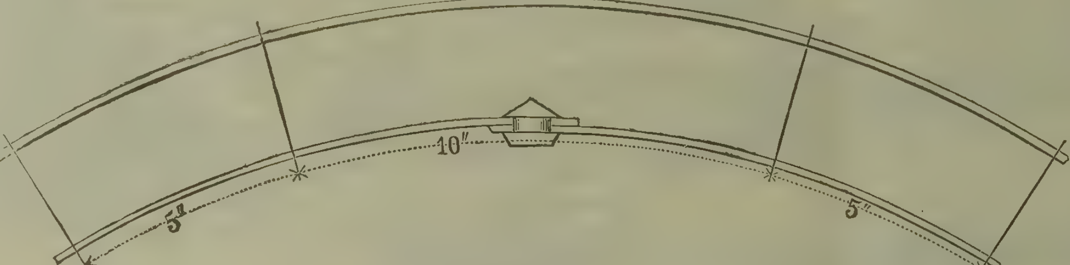


Fig. 2.

It was located, with another one of the horizontal tubular type, in a one-story brick boiler-house, and was in the care of a fireman of exceptionally careful habits. He had been twenty years in the same employ, and was noted for his faithfulness in carrying out the directions which he received for the management of his boilers. Although he did not possess a thorough knowledge of engineering, yet he was relied on as worthy of all confidence in the performance of the duties of his occupation.

The boiler was $6\frac{1}{2}$ feet high by $3\frac{1}{2}$ feet diameter. The shell was $^5/_{16}$-inch iron, and the furnace and uptake called $\frac{1}{4}$-inch, but were really $^{22}/_{100}$th thick. The furnace was 36 inches diameter, and the uptake 34 inches diameter; they were stayed to the shell by two rows of screw-stays in the furnace and one row in the uptake, spaced about 5 inches apart circumferentially. The boiler contained 56 tubes $2\frac{1}{2}$ inches in diameter by about 8 feet long.

Referring to Fig. 1, which was copied from a photograph, it will be seen that about all that part of the furnace which is embraced in the view, is stripped of its plates, leaving the stays attached to the shell. There are a number of pieces hanging to the borders of the opening after the explosion, but they had been broken off and carried away by curiosity seekers before the photograph was taken. The immediate cause of this explosion is not as clearly defined as has been the case in most of the accidents that have been illustrated in the *Locomotive*, which is chiefly due to the meagerness of the information that could be obtained at the scene of the wreck. There is little doubt, however, about the existence of a weakness at one of the vertical seams of the furnace.

By reference to Fig. 2, which is a horizontal section through a part of the water-space and the shell and furnace plates, it will be seen that the vertical seam which joins the furnace plates together, is at a point where there should be a stay-bolt in each row, but they were omitted, leaving the seam in a space double the length of the rest of the spaces between stays. The question occurs whether or not this arc, which is double the length of the others in this thin boiler plate, is sufficiently reinforced by the lap to compensate for the imperfection of form incident to all laps in a cylinder. A rupture along this seam close to the calking edge, would tend to weaken our confidence in its strength. Such a rupture did occur. But the furnace with this imperfection, and with all its stays sound, must have been capable of withstanding something much higher in the way of pressure than is usually put upon such structures. The conclusion, therefore, is unavoidable that either a number of stays were broken or the pressure was excessive at the instant of the explosion.

How to Fire Steam Boilers.

Mr. J. F. Tallant, in the *Milling World*, tells the amateur engineer how to fire steam boilers. He says that in placing a steam boiler in a furnace, it is usual to employ grate bars, even for coal, about 4 feet long —the same length that was necessary where wood fuel was used. The rear end of the bars should be at least the thickness of a brick, or upwards of 2 inches lower than the front. The boiler should also be placed 2 inches lower at the rear than at the front, and the bridge wall should come within 3 inches of the boiler, if the draft is good.

The best grate bars now used are of a zigzag shape on the top, so closely placed that coal lumps upwards of one-eighth of an inch through cannot drop between. Three stoking pokers should be used—one a plain straight poker, another with claws, and the third like a hoe. In firing, the coal should be so distributed as to be totally consumed without smoke, if possible—the more smoke, the worse the firing.

After steam is raised and work fully begun, in replenishing the fire, the glowing coals should be pushed back with the iron hoe toward the bridge wall, and if any clinker is seen, remove with the claws. The fresh coal should be well scattered over the front, so that the smoke will pass over the red hot coals and be consumed by them. Avoid making piles of coals on the bars. It is often beneficial to have a very small steam pipe open into the furnace, to give a spray of steam to the flaming mass. Water being composed of two most combustible ingredients—oxygen and hydrogen gases—when the steam is decomposed the heat becomes most intense.* This pipe should be regulated by a cock, and its use requires considerable skill, as an over-supply of steam will quench the fire instead of increasing it.

To permit a boiler to run too full of water, is as wasteful of fuel as it would be dangerous to have too little. Of the two extremes, the latter is most common, generally through carelessness. To fire efficiently yet economically, is a very skillful, intelligent operation, and the man who can do it, and actually does it for his employers, cannot be too highly esteemed by them, or be too well paid. Brains and vigilance as well as main strength and muscle must be used continually.

Yankee Progress in Australia.

A correspondent of the London *Ironmonger*, writing from Sydney, Australia, says: "The statement that British makers have no need to fear American competition, is likely to produce misconception. Few unbiassed observers will endorse his view, for the progress made by our cousins in the last fifteen or twenty years has been very great, and the United States agents at the exhibition appear satisfied with their future prospects. As one instance, I may mention that Messrs. Fairbanks, of New York, have just secured the contract for the supply of weighing bridges to the government railways in Victoria. A large ironmonger here told me the other day that whereas twenty years ago American and foreign goods constituted only 5 per cent of his stock, they now amount to 20 or 25 per cent. American goods of many classes, he assures me, are largely preferred to English, not only by the consumers, who can judge of the quality, but by the trade, on account of the careful, practical way in which they are packed, and the correctness with which orders are executed. He instanced English screws as an apt illustration of the latter point. One case will perhaps have several gross below its proper contents, while another will have too many. He gets all he

* This statement may be liable to mislead our readers. There is a gain in heating effect where steam in small quantity is introduced as above stated, but the cause of this gain is due simply to the fact that the steam jet brings the furnace gases into more perfect contact with the air, thus insuring a more complete combustion. There is no gain from the decomposition of the steam.—*Ed. M. & B.*

pays for, but in such an uncertain, slap-dash way that every case has to be examined before being sent to the country. He sends American goods away just as they come, with perfect confidence that all will be right. Again, he says, there is an almost absolute identity even in the commonest articles of American make, while the English differ materially; and altogether, the trouble of doing business with English houses is very great, owing to the lack of proper control by experienced men. In locks and screws the Yankees are not making much if any headway, their cheap goods being too rough, and their best makes too dear; but in adzes, picks, and axes they have superseded us, and are beginning to do so in ordinary hand-saws."

The Food Adulteration Question.

This question appears just at the present time to be attracting a large share of attention, and its importance and general interest render any apology for the considerable space we devote to it quite unnecessary. In our issue for May of last year, we referred editorially at some length to the necessity of sound, sensible and uniform legislation upon the subject of regulating the sales of articles of food and drink and drugs, and for the imposition of adequate penalties for their falsification. In that article we remarked, that to secure such legislation on this subject as shall accomplish the purpose of protecting the public against the dangers of injurious food adulteration, that shall be uniform in their character, and that shall not impose unnecessary and troublesome restrictions upon trade, was a task of extreme difficulty. We referred then to the fact that the National Board of Trade had taken the subject in hand, and at their meeting held in December, 1879, had decided to offer a prize of $1,000 to be awarded in open competition for the best draft of a "Food Adulteration Act." The committee of the Board of Trade charged with the duty of examining the essays submitted for the prizes, consisting of John S. Billings, C. Williamson, C. F. Chandler, and A. H. Hardy, have just made a report to the Board. In this report they select, as the three most meritorious essays, with accompanying acts, the following, which are named in the order of their merit: First, that of G. W. Wigner, F.C.S., of London; second, that of Vernon M. Davis, of New York city; and third, that Wm. H. Newell, M.D., of Jersey City Hights, N. J.

In connection with the above, the committee submit the following remarks bearing on the general subject, which we reproduce by courtesy of the editor of the *Sanitary Engineer:*

1. In view of the statements which for the last two or three years have from time to time been made with regard to the prevalence in this country of adulterations of food which are dangerous to health and life, and which have created so much agitation in the public mind as to induce the National Board of Trade to establish this competition, it is very gratifying to find that none of the essayists produce any definite or satisfactory evidence as to the widespread existence of such dangerous adulterations in this country. The absence of such evidence, in addition to the results recently obtained by several expert chemists in extensive series of analyses of the usual articles of food in this country, which results have been made known to the committee, fully warrants us in declaring that none of our staple articles of food or drink are so commonly adulterated as to be dangerous to health or life. Such dangerous adulterations appear to be mainly in the form of poisonous colors or coloring matters, as, for instance, in confectionery; and even these are rare.

2. The question of the adulteration of food, with perhaps the exception of milk, should therefore be considered not so much from a sanitary standpoint as from that of commercial interests—as being of the nature of a fraud, in aiding the sale of articles which are not what they are represented to be. The main objects of legislation upon this subject should be to prevent deception, to furnish to the public authoritative information, and nullify the operations of ignorant and sensational alarmists, who damage the business interests of the country quite as much as do the evils of which they complain.

3. We are of the opinion that there is much more danger to health and life in this country from adulterated drugs than there is from adulterated food, and that any legislation which is to deal with the one should also deal with the other.

4. To indicate the legislation upon the adulteration of food and drugs, which will protect health and prevent fraud, and at the same time not impose unnecessary burdens upon trade, is a matter of very great difficulty, as the result of this competition clearly shows, for we do not consider any of the Acts proposed to be satisfactory. In this matter it is much better at first to do too little than too much, and the first steps in such legislation should be tentative and educational in character.

5. While it is highly desirable that the general principles of legislation on this subject should be the same in all States, we do not think it possible to secure by State laws absolute uniformity in the details in all parts of this country, and it would therefore be unwise to make the attempt.

6. We do not think that any law upon the adulteration of food and drugs can be made efficient without a properly constituted health authority to supervise its execution. The questions involved are in a high degree technical, and require special training in those charged with administering the law. At the same time, we think that the existence of such health authorities should be taken for granted in the Acts, and that these should not attempt to create them. We believe that every State should have a Board of Health, but that such Boards should be created by independent legislation.

7. We think it unadvisable that the law should attempt to define in detail as to what an adulteration is. A very considerable amount of discretion should be left to the Board of Health in this respect, limiting it only in the direction of possible over-rigidity. Many well recognized articles of commerce, although harmless and even useful, may be said to be adulterated, and it should be left to the discretion of the Board to exempt any article from the penalties imposed by the Act.

8. Care should be taken not to make the penalties excessive. It should be remembered that mere exposure of fraudulent practices, if effectually and persistently made, is in itself a penalty, and as a rule public opinion may be trusted to make such practices unprofitable if measures be taken to make this opinion a correct one, which we think should be the great object of the law proposed. Under no circumstances should fees or moieties to informers be allowed.

9. We think that both State and national laws upon this subject are desirable. The State law should deal with the subject in the individual State. The national law should deal with adulterated articles coming from foreign countries, or passing from one State into another, and also with adulteration in the Territories, the District of Columbia, and in all places under the special jurisdiction of the United States. It is, of course, in the highest degree desirable that the State and United States legislation on this subject should not be discordant. The educational feature should be even more prominent in the national than in the State law, while the punitive feature should, if anything, be less severe. As the State laws will vary somewhat in this last respect, it follows that the penalties in the United States laws should be at a minimum.

10. The Committee will endeavor to prepare, and place in the hands of the President of the National Board of Trade, as soon as possible drafts of the Acts, prepared in accordance with the general principles contained in this report.

All of which is respectfully submitted by the Committee of Award.

As will be seen from the last statement of the committee's report, they are engaged in the preparation of a national and State Bill designed to secure the results which the competition was instituted to accomplish. The committee is composed of men who are highly competent, we think, for the task, though it is both difficult and delicate. We shall look for their recommendations and the subsequent action of the Board of Trade, with special interest. We owe thanks to our neighbor, the *Sanitary Engineer*, for the courtesy of placing an advance sheet of its supplement, containing the first results of the committee's labors, at our disposal.

Who Invented Celluloid?

It would appear from late publications, that this singular substance was not of American origin, although the remarkable commercial success that has attended its manufacture is entirely due to the business skill and enterprise of the owners of the American patents covering its manufacture. The actual state of the facts seems to be that substantially the same substance that is now widely known and used under the name of "Celluloid," was originally made and patented by Alexander Parkes, of Birmingham, England, in the years 1855—about 15 years before the American patents of the brothers Hyatt, of Newark, N. J., were granted. This same Parkes subsequently took out numerous patents for improvements upon his original mode of manufacture, and for a variety of applications of his material. The product was called after the inventor, "Parkesine," and a company was formed called the Parkesine Company (limited), to manufacture and sell the product, of which a certain Mr. D. Spill was working manager.

Medals were awarded to Mr. Parkes for his invention at the British Exhibition of 1862, and at the Paris Exposition of 1867. The operations of this company seem to have been unsuccessful, and the product never attained to any popularity or general introduction until the American manufacture of celluloid commenced shortly after the granting of American patents to the brothers Hyatt, who have been generally credited with the honor of having made the invention. We have not yet been able to make a comparison between the patents of Parkes and the Hyatts, to determine whether there is any substantial difference between them; and until such time, we shall not venture to affirm what the English journals unhesitatingly do—namely, that celluloid is simply an American reproduction of the English "Parkesine." We must confess, however, from the evidence that has been presented, that they make out a very strong case. We hope to present the results of an examination of this interesting subject, from official documents, in one of our early issues.

Commerce of the United States.

The exports of merchandise from the United States during the month of September, 1880, are valued at $71,194,820, and the imports at $53,226,435, against exports in September, 1870, amounting to $65,444,055, and the imports to $44,224,878. For the whole nine months ended September 30, 1880, the exports were $622,055,854, and the imports $548,294,424, against exports during the corresponding nine months of last year, of $517,241,758, and imports of $355,743,422. In the whole year ended September 30, 1880, the exports aggregated $869,972,921, and the imports $706,153,798, which sums are contrasted with a total of exports of $720,394,554, and of imports of $462,944,187 in the year ending at the same date 1879.

Of gold and silver coin and bullion, the exports in September, 1880, were $565,844, and the imports $19,660,933, against exports to $1,231,000 in the same month of 1879, and imports to $28,361,587. During the nine months ended September 30, 1880, the exports were $9,972,518, and the imports $39,502,223, against exports to $21,033,863, and imports to $46,515,595 in the corresponding term of 1879. In the whole year ending September 30, 1880, the exports were $14,755,653, and the imports $86,179,586, as contrasted with exports of $25,939,729, and imports of $53,104,-

550 in the year, ended at the same date, 1879. This brings the total of both merchandise and specie exported in September, 1880, to $71,760,664, and of that imported to $72,887,368, against exports in September, 1879, to $66,675,055, and imports to $72,586,465. The total for the nine months ended September 30, 1880, shows exports to $632,027,372, and imports to $587,796,647, against exports in the same period of 1879 amounting to $538,275,621, and imports to $402,-

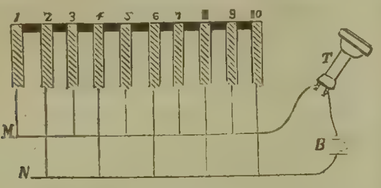


FIG I

Bell's Photophone—Section of Selenium Cell.

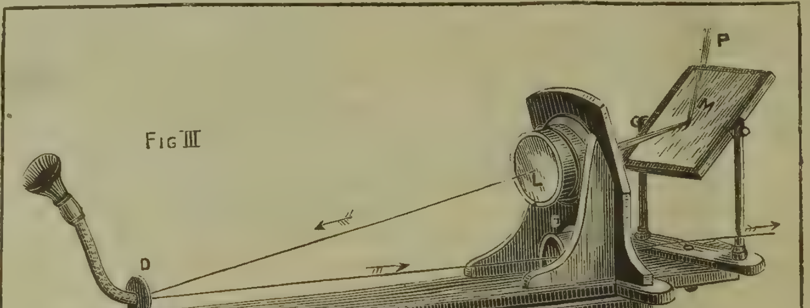
259,017. This gives a grand total for the year ended September 30, 1880, of $884,728,574 of exports and $792,333,384 of imports, against $746,334,283 of exports, and $516,048,737 of imports in the year ending at the same date in 1879.

The Photophone.

The theory of the photophone, which depends for its action on the influence of light in affecting or modifying the electrical conductivity of selenium, was explained at some length in this journal immediately upon the announcement by Prof. Bell of his highly interesting discovery. We are enabled this month to place before our readers several illustrations of the apparatus, which will serve to render the action of the photophone more intelligible.

The curious phenomenon presented by metalloid selenium above referred to, has attracted the attention of investigators for the past ten years, but up to the present announcement of the photophone, no application worthy of mention had been made of it. One of the greatest difficulties encountered in the attempts to utilize selenium, has always been the construction of a practically successful selenium cell, by which its sensitiveness to light of varying intensity could be utilized; and this difficulty is due chiefly to the fact that selenium offers great resistance to the passage of the electrical current. Because of this great resistance, therefore, selenium can only be used in the form of an exceedingly thin sheet or film, for the reason that the working of the telephone, which is part of the apparatus about to be described, would be interferred with by too strong a current. The earlier experiments to meet the conditions of the problem, by fixing a thin film of selenium between two plates of platinum or iron, very near together, and introduced into the galvanic circuit, were not successful, for the reason that the selenium could not be brought into proper contact with the metallic surfaces.

After numberless experiments, Messrs. Bell and Taintor found that the substance best suited for the contact surfaces of the selenium cell was brass, although at first it was thought to be unsuited because of the chemical action that was anticipated. This action it was found did take place, but proved unexpectedly to be advantageous. A portion of the copper of the brass unites with the selenium to form a seleiide of copper, which forms an excellent surface for the attachment of the selenium, and thus affords the extended surface of contact between the selenium and the metal which was sought. The investigators found it best to give the cell the form of a cylinder, as the light rays could be readily concentrated upon its sensitive surface with the aid of a parabolic mirror. The cylinder is made up of a number of insulated brass disks, of which the odd and even members are connected by metallic wires. This construction is shown in Fig. 1, which is a cross section of the cylinder; M and N indicate the conducting wires, B the battery, and T the telephone. Each of the brass disks (shown cross-lined and numbered in the cut) is insulated from the adjacent disks, so that the electric circuit is not complete. The edges of these disks are brought into electrical contact by means of the selenium, which is indicated in black in the cut. The cylinder, formed of the series of united but electrically insulated brass disks very close together, is heated to the melting point of selenium, and then rolled to and fro upon a sheet of plate glass covered with a film of melted selenium. By this means the selenium is pressed in between the surfaces of the series of disks. After the selenium has hardened, the cylinder is turned off in a lathe. By this method of procedure there is left on the surface of the cylinder a comparatively large surface which is sensitive to light, while the selenium film is exceedingly thin. The disks are made somewhat thicker at their circumferences, so that here the selenium film is the thinnest. In this manner the before mentioned investigators have succeeded in devising a selenium cell which in the dark only offers a resistance to the electric current of 300 ohms.



Bell's Photophone Used with the Electric Light.

Fig. 2 shows the essential parts of the photophone of Messrs. Bell and Taintor. The light rays are received on a mirror M, from this reflected upon the lens L, from which they are condensed upon the mirror-diaphragm D, after passing through the alum cell *c*, which eliminates the non-luminous heat rays. The mirror D, which is supported by the mouthpiece O, is caused to vibrate by the voice of the speaker behind it, and impresses corresponding irregularities upon the light reflected from it. These affected light rays are thrown from the mirror upon the surface of the parabolic mirror P, in the focus of which is fixed the above described selenium cell. The sensitive selenium cell,

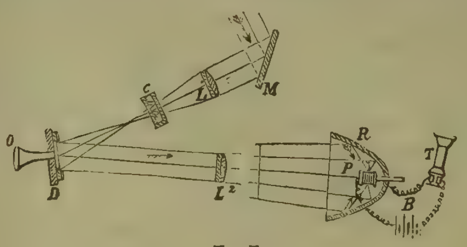


FIG II

Bell's Photophone—Sectional View.

receiving the light reflected from the diaphragm D, affected irregularly, as to its intensity, by the sound vibrations, responds to these irregularities in corresponding affections of its electrical conductivity. The electrical current meets with less resistance in the selenium, as the light falling on it is more intense, and *vice versa;* and these modifications of luminous intensity produce a strengthening or weakening of the magnet of the telephone T. The strength of the magnet, therefore, varies according to the character of the sound waves impressed upon the diaphragm-mirror D, and by the affection of the magnet as just described, the same sound waves are reproduced in the telephone.

Fig. 3 gives the appearance of the apparatus on a larger scale than in Fig. 2, by comparison with which the corresponding parts will be recognized.

Fig. 4 is the apparatus modified by the employment of the electric light L, in which case a reflector R is employed to throw the rays parallel upon the transmitting diaphragm T.

Artificial Production of Indigo.

Prof. Baeyer, of Munich, who some time ago electrified the chemical world by announcing that he had succeeded in effecting the synthesis of indigo, has been steadily engaged upon the same problem, with the view of simplifying and cheapening the procedure so as to make it commercially valuable. It is interesting to be able to record what appears to be an indication that he is making some progress in this direction, in the announcement that he has lately taken out patents upon two processes for the artificial production of this important dyestuff. In one of these, it is stated, the indigo is produced at once in the fiber of the textile by the chemical reactions of the materials employed. The detailed reactions by which artificial indigo is formed are not suited for popular abstraction. We may state, however, that Baeyer starts with cinnamic acid (contained in storax, and in Peru and tolu balsams). This is converted to nitro-cinnamic acid by nitrification. This nitro-derivative is treated with bromine, the resulting product is boiled with alcoholic potash solution, and this product, which bears the name of orthonitrophenylpropiolic acid, when treated with an alkali and a reducing agent simultaneously (as, for example, a mixture of glucose and an alkaline carbonate), yields, at a temperature of about 110° C. (=230°Fah.), indigotine,

which separates out in crystals. As above remarked, the indigo by this process can be produced directly in the fiber of a textile, as the textile needs simply to be impregnated with the mixture of orthonitrophenylpropiolic acid and the glucose and alkaline carbonate, and then exposed to a current of steam at the above named temperature, when the indigo is formed directly upon it. From these remarks, our readers may infer that the time is not very distant when the production of artificial indigo on a commercial scale will be economically practiced.

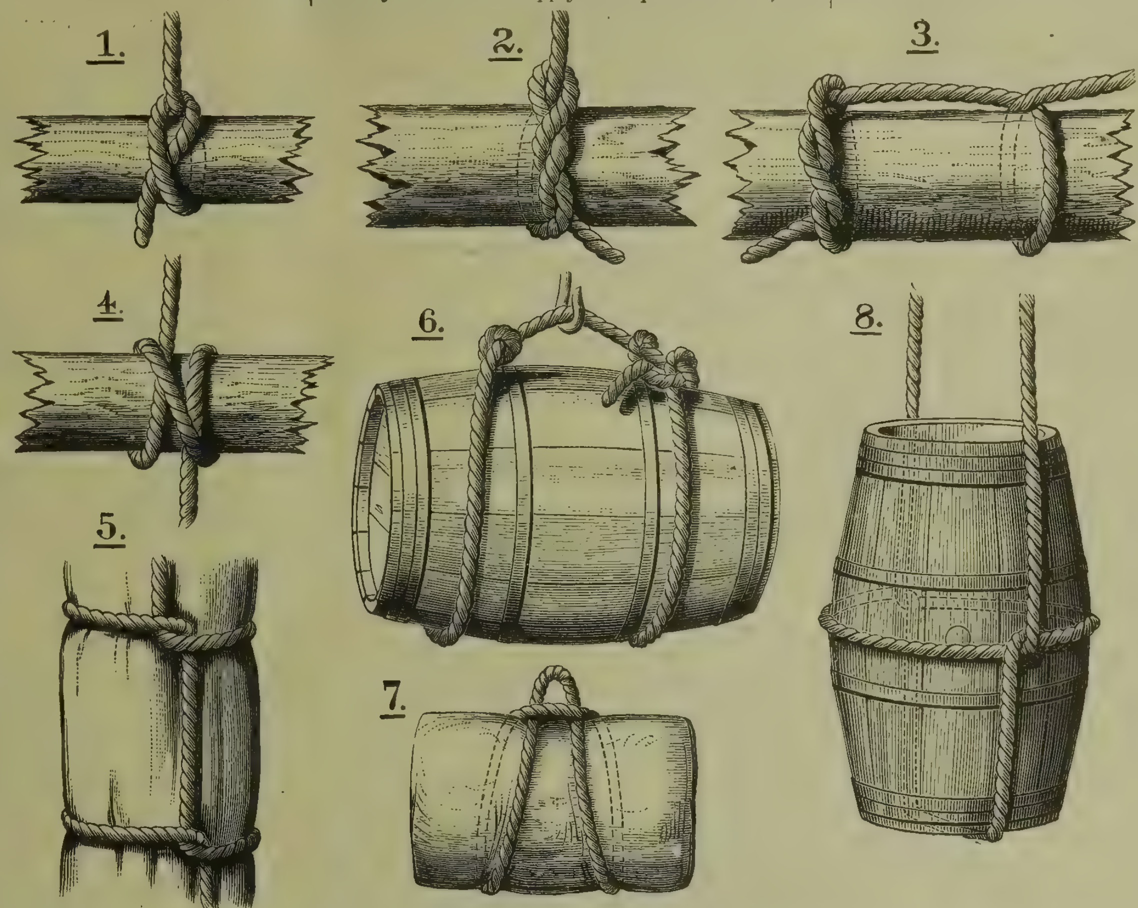
Lifting Tackle.

Every engineer, builder, and millwright knows the great importance that is attached to lifting heavy weights and fixing materials and machinery. It is no use for work to be properly finished if accidents happen in fixing. The young and inexperienced erector is frequently at a loss to know how and where to attach his ropes and other appliances to secure the best results, and, worst of all, no effort is made to teach him—he must rely entirely on his own observations. So well known is this ignorance with respect to lifting and hoisting in mechanical trades, that it is often stated, and often acted upon, that an old sailor makes the best erector. He is as nimble as a monkey on a pole or scaffold. We know very well that in our younger days, we experienced considerable difficulty in obtaining information respecting knots, loops and other rope fastenings.

No doubt all who have to do with the moving of machinery and other heavy masses, will find the rope knots and fastenings shown in the adjoined engraving very useful. The information is not only very useful when away from home in foreign countries, or away from the workshop—the man who understands the use of rope tackle is a king among his fellows.

We have often thought that in these days of steam cranes and hydraulic jacks, men are not so ready in resources as they were many years ago; they trust too much to machinery and too little to themselves; they seem afraid to exert their real strength at the end of a rope. If we can only induce a few of our readers to study the art of lifting weights and encourage confidence in manual strength, we shall not consider our efforts to have been in vain.

The various kinds of knots and loops shown in the engravings are as follows: Fig. 1, half hitch; Fig. 2, timber hitch; Fig. 3, half hitch and timber hitch; Fig. 4, clove hitch; Fig. 5, hammock hitch; Fig. 6, cask hitch; Fig. 7, bale hitch; Fig. 8, butt or end sling.



ROPE LIFTING TACKLE.

Hand-Reels for Reeling Silk.

The Women's Silk Culture Association of the United States, an organization which, with great energy and promise of success, has engaged in the work of introducing the culture of silk as a domestic industry in this country, has progressed so far as to have discovered the need of a hand-reel suitable for home use, that those who raise cocoons may be able with its use to reel the silk, and thus put it in a form in which it will be useful to our home manufacturers. In a note to the editor of this journal, the President of the Association gives the following facts, which we publish with the hope that some of our mechanical readers will be able to supply the need of the Association. The President expresses herself as follows:

"The economical production of cocoons is no longer a problem in this country. The worms thrive almost everywhere, and in every community are women and children who have plenty of unoccupied time which can be utilized easily and pleasantly in the production of cocoons. But silk manufacturers furnish no market for cocoons; they want reeled silk. The unwinding of the cocoons may be done in special establishments erected for the purpose, and were the silk growers sufficiently numerous to supply the requisite cocoons, such 'filatures' would no doubt be provided, and so furnish a market here for the cocoons raised. As yet, however, the silk growers are too few and too scattered to support such establishments. Accordingly it becomes necessary, in the domestication of the silk industry, to provide a simple hand-reel with which those who raise the cocoons can also unwind them. The reels should be simple in construction, small, and inexpensive, preferably of metal, as less liable than wood to atmospheric changes, and capable of turning off a warp answering the requirements of marketable silk. Obviously, a reel to meet the present demand will make for itself a much wider demand, since many who are now prevented from engaging in silk production, by their inability to meet the demands of the trade for reeled silk, would doubtless engage in the work if the proper reel were provided. Our silk manufacturers are now, in the infancy of the business in this country, using $10,000,000 worth of raw silk a year."

The Association believe that the agriculturists of the United States will ultimately produce—nay, must produce, this amount of raw silk, and more. They report that the industry is exciting a warm interest in all parts of the country, and that from every State in the Union there comes a plea for the establishment of just such a home industry. We trust that our mechanical readers may give the above facts and explanations their attention. Those who may wish to communicate with the association, should address the President, Mrs. John Lucas, at the office of the Association, 1328 Chestnut street, Philadelphia.

"Weighting" of Textiles.

Prof. Mallet, in his interesting review of the important changes in the industrial applications of chemistry within the last few years, which appears in the *American Chemical Journal*, draws special attention to the extending habit on the part of many manufacturers of fraudulently "weighting" textile fabrics with foreign substances introduced to give apparent density to flimsy products of the loom. He remarks that cotton and silk have been the materials chiefly treated by such objectionable methods. The sizing legitimately used upon the warp of cotton goods to give strength and smoothness of surface to the threads in weaving, consists mainly of flour, with the gluten partially altered by fermentation with soap and fatty matter, and should not much exceed five per cent of the weight of the finished cloth; but white porcelain clay in large quantity, magnesium chloride to attract and retain moisture, and chloride of zinc to produce the same effect, and also to act as an antiseptic to obviate mildew, have been extensively employed of late years, sometimes forming altogether fifty, or even sixty-five per cent of the weight of the fabric as sold.

Silk goods, he adds, are also notoriously "weighted" to an enormous extent, chiefly in the course of nominal dyeing, both organic and mineral substances being used. Among the substances used for this purpose, he enumerates salts of lead, barium, aluminum, etc., with viscid material, such as shellac dissolved in a watery solution of borax, to produce attachment to the cloth, and hygroscopic substances to attract moisture, often with serious injury to the durability of the real fabric, which is more or less corroded and weakened. He refers to cases in which the addition of such foreign substances has amounted to as much as two-thirds of the weight of the finished product.

Coating Cotton Thread with Silk.—A company has been formed in Paris to work an invention for coating thread with silk. The invention embraces, according to the *Bulletin des Soies*, a chemical process for covering linen or other vegetable threads with a mesh of silken matter in a way similar to that in which metallic objects are plated with gold or silver. The process is dependent on forming a solution of the silk in zincic chloride, or other solvent, and passing through the solution the thread to be coated, which has previously been mordanted in a bath, so that the silk is precipitated upon it. The practicability of the process from a commercial standpoint, we think is questionable.

Scientific.

WHAT MAINTAINS THE SUN'S HEAT?—Prof. C. A. Young, in a highly interesting paper which he has lately published, gives his views concerning the present state of our knowledge of the question above propounded. He declares it to be quite certain that it is not a case of mere combustion, since it has been shown that, even supposing the sun were composed of solid coal burning in pure oxygen, it could only last about 6,000 years, and must therefore have been nearly one-third consumed since the beginning of the Christian era. Nor can the source of its heat lie simply in the cooling of its incandescent mass, for huge as this is, its temperature must have fallen perceptibly within a thousand years if this were the case.

He then proceeds to discuss the merits of the two most reasonable theories that have been advanced to explain the problem, both of which he thinks are true to some extent. One of these theories maintains that the chief source of the solar heat is the impact of meteoric matter; the other maintains that the source of this heat is the slow contraction of the sun. As to the first of these theories, Prof. Young states that it is quite certain that some of the solar heat is produced in that way; but the question is, whether the supply of meteoric matter can be sufficient to account for any great proportion of the whole. As to the second, he holds that there is no question as to the adequacy of the hypothesis to account for the whole supply of solar heat; but there is as yet no direct evidence that the sun is shrinking.

The basis of the meteoric theory is the well-known fact that if a moving body be stopped, either suddenly or gradually, a quantity of heat is generated. A huge body moving with high velocity, would, if suddenly brought to rest, develop immense quantities of heat. With reference to this theory, Sir William Thomson has calculated the amount of heat which would be produced by each of the planets falling into the sun from its present orbit. The results are as follows, the heat produced being expressed by giving the number of years and days through which it would maintain the sun's present expenditure of energy:

	Years.	Days.
Mercury	6	219
Venus	83	326
Earth	95	19
Mars	12	259
Jupiter	32,254	...
Saturn	9,652	...
Uranus	1,610	...
Neptune	1,890	...

The collapse of all the planets upon the sun, therefore, would generate heat enough to maintain the sun's supply for nearly 46,000 years; and to keep up its radiation indefinitely, would require that a quantity of matter equal to about one-hundredth of the mass of the earth should fall upon the sun's surface annually. This constant increase of the sun would cause an acceleration of the motions of the planets—a shortening of their periods of revolution; but this acceleration would be so trifling that it would require centuries before it would become sensible.

The question is, then, whether any such quantity of matter can be supposed to annually reach the sun? Prof. Young admits that it is impossible to deny it dogmatically, but deems it improbable on astronomical grounds. If so large a quantity of matter falls annually upon the solar surface, he explains, it will be necessary to suppose a vastly greater quantity circulating about the sun between it and the planet Mercury. And, again, the process by which the orbit of a meteoric body is so changed as to make it enter the solar atmosphere, is a very slow one, so that only a very small proportion of the whole could be caught in any given year. But if there were present near the sun any considerable quantity of meteoric matter—say anything like the mass of the earth, for example, it ought to produce a very observable influence upon the motions of the planet Mercury—an effect which has not yet been observed.

For this reason, says Prof. Young, astronomers, while conceding that a portion, and possibly a considerable portion, of the solar heat may be accounted for on this hypothesis, are disposed to look further for their explanation of the principal revenue of solar energy. This, he states, they find in the probable slow contraction of the sun's diameter, and the gradual liquefaction and solidification of the gaseous mass. The same total amount of heat is produced when a body moves against a resistance which brings it to rest gradually, as if it had fallen through the same distance freely and been suddenly stopped. If, then, the sun does contract, heat is necessarily produced by the process, and that in enormous quantity, since the attracting force at the solar surface is more than twenty-seven times as great as gravity at the surface of the earth, and the contracting mass is as immense. In this contraction, every particle of the sun's mass, excepting only that at its exact center, contributes something to the evolution of heat.

Helmholtz has shown that even under the most unfavorable conditions, a contraction of about 250 feet a year in the sun's diameter—a mile in 21 years—would account for its whole annual heat emission. This rate of contraction is so slow that it would be quite imperceptible to observation. It would require 9,500 years to reduce the sun's diameter a single second of arc ($1''$=450 miles at the sun's surface), and nothing less than this could be detected with certainty.

If this theory of the source of the sun's heat is correct, it follows that it must come to an end in time; and looking backward, we must infer that it had a beginning. Time was when there was no such solar heat as now; and the time must come when it will cease.

Prof. Young refers at this point of his instructive article to Prof. Newcomb's study of this subject. According to the latter, if the sun maintains its present radiation, it will have shrunk to half its present diameter in about five millions of years at the longest. As it must, when reduced to this size, be eight times as dense as now, it can hardly then continue to be mainly gaseous, and its temperature must have begun to fall. Prof. Newcomb, therefore, concludes that it is hardly likely that the sun can continue to give sufficient heat to support life (as we know it) on the earth for ten millions of years from the present time.

From the mass of the sun, and its present radiation, Prof. Young then proceeds to compute how long the solar fire can have been maintained at its present intensity by the process of condensation. He affirms it to be demonstrable that the contraction of the sun from a diameter many times larger than the orbit of Neptune, to its present dimensions, would have furnished about eighteen million times as much heat as the sun now supplies in a year, and that, therefore, the sun cannot have been emitting heat at its present rate for more than that length of time, if its heat has been generated in this manner.

Holding this hypothesis to be in the main true, he reaches the conclusion that the total life of the solar system, from its birth to its death, is included in some such space of time as thirty millions of years, and that no reasonable allowances for the fall of meteoric matter, based on what we are now able to observe, or for the development of heat by liquefaction, solidification, and chemical combination of dissociated vapors, could raise it to sixty millions. At the same time, he is prudent enough to admit that there may have been, and may be in the future, ways of which we have no conception, by which the energy apparently lost in space may be returned, by which burnt-out suns and run-down systems may be restored, or catastrophies which in a few hours or moments might restore the wasted energy of ages. But, he holds, the whole course and tendency of things, so far as science now makes out, points backward to a beginning and forward to an end.

Those of our readers who may wish to consult Prof. Young's paper in full, which will amply repay reading and study, are referred to the *Popular Science Monthly* for November, 1880, in which it appears.

A CRITICAL INVESTIGATION OF A NUMBER OF ALLEGED NEW ELEMENTS.—In the London *Nature*, we observe that Mr. Humpidge has courageously undertaken the herculean task of critically reviewing the claims of a number of alleged discoveries of new elements, concerning the genuineness of many of which the chemical world is as yet very much in doubt. Some of these alleged discoveries are no doubt genuine acquisitions to science, some have probably been duplicated by different investigators, and others will doubtless be found to be worthless. The task of separating the wheat from the chaff by a critical review and comparison of so many and such confusing announcements is one which will require rare analytical skill and sound, impartial judgment. Mr. Humpidge, as we remarked above, has essayed the difficult task with the following results:

Concerning davyum, which was announced in 1877 by Sergius Kern as a new element belonging to the platinum group, Mr. Humpidge expresses the opinion that the investigator failed to take the necessary precautions to eliminate the platinum metals and iron; or, at least, that he fails to state how he did so. He holds, on this account, that the existence of this alleged new element has not been satisfactorily proven, and that the discovery may therefore for the present be ignored.

Concerning the numerous alleged new members of the yttrium group of metals, the discovery of which have lately been announced with bewildering rapidity, the author recognizes the extreme difficulty of discriminating between genuine and faulty announcements, because of the close resemblance of these metals. He makes, however, a very exhaustive analysis of the claims of these new (?) applicants for recognition, from which we present his conclusions in the appended tabulation. At the present time, this is probably the most trustworthy estimate that we have, of the credit that must be given to these confusing announcements.

	Name.	*Symbol & atomic weight.*	*Discoverer.*
	Scandium (doubtful)	Sc=45	Nilson.
	Yttrium	Yt=89	Bunsen & Clève.
Probably identical.	Phillipium	Pp=111	Delafontaine.
	Unnamed metal of Soret	atomic w'ght undeterm'd.	Soret.
	Thulium		Clève.
Probably identical.	X of Soret	atomic w'ght undeterm'd.	Soret.
	Holmium		Clève.
	Terbium	Tr=147	Marignac.
Probably identical.	Samarium (doubtful)	atomic w'ght undeterm'd.	Boisbaudran.
	Decipium (doubtful)	Dp.=159	Delafontaine.
	Yβ	=149.4	Marignac.
	Yα	=156.7	Marignac.
	Erbium	Er	Mosander.
	Ytterbium	Yb=172	Marignac.

Phillipium, the unnamed metal of Soret, Thulium, X of Soret, Holmium, Decipium, Yβ, and Erbium give distinct absorption spectra.

Two alleged discoveries of Dr. J. Lawrence Smith—one of an unnamed earth, observed in the mineral gadolinite of North Carolina, and another which he held to be identical with X of Soret—are not credited by Mr. Humpidge. Concerning Norwegium and Vesbium, the author states that for the present we must suspend judgment on their claims to recognition, as up to the present the proofs alleged to demonstrate their existence have not been verified.

Mr. Humpidge deserves the thanks of the chemical world for his careful effort to sift the mass of conflicting evidence in these troublesome announcements. The difficulty of the task, however, is so great that some time and much additional labor will be required before the wheat can be completely sifted from the chaff.

A LECTURE EXPERIMENT.—Take a glass flask of the kind usually employed in the laboratory and having about the capacity of a liter. Fill this partially with water, and close its mouth with a rubber or paraffined cork stopper, through which a glass tube passes which terminates flush with the lower surface of the stopper. Above, the tube is bent twice at right angles, the outer extremity being so placed as to dip below the surface

of water of ordinary temperature. Now apply heat to the flask until the contained water boils freely, and so soon as the air has been expelled from it by the steam evolved, withdraw the flame and allow the cold water to ascend the tube and enter the flask, which it will promptly do as the steam condenses.

As the first portions of cold water enter the flask, however, the residual steam therein is so rapidly condensed that a brisk ebullition will set in, which for a time will check the influx of water, driving it down the tube. A further cooling of the flask speedily causes more water to enter through the tube by atmospheric pressure, when the same phenomenon will be repeated. After two or three oscillations of this kind, the water will flow into the flask continuously, and with great velocity, until it is completely filled. The experiment should be terminated, however, just before complete filling occurs, by withdrawing the tube from the water, as the shock with which the experiment is completed will usually break the flask.

TRANSFORMATION OF SOUND INTO LIGHT.—We glean from the *Popular Science Monthly* the following account of a curious experiment made by M. Trève, and presented by him before the French Academy. His experiment was made with the apparatus called the "singing condenser," with the use of which he holds that he has actually produced the transformation of sound into light. The experiment is thus described:

If we bring the current of a Ruhmkorff coil to bear upon one of these condensers, the latter will repeat on a larger scale the vibratory movement of the coil. The noise which it makes is due to the vibrations of the air in the condenser under the shock of the electric current. If we put a light pressure upon the leaves of the condenser, the sound will be diminished in proportion as the pressure is increased, till it ceases.

Reversing this experiment, M. Trève put a condenser into a Geissler tube, and brought the two poles of the inductive current of the Ruhmkorff coil to bear upon it through the electrodes of the tube. The tube was then connected with an air pump. The condenser sounded as usual when the current was directed to it, under the ordinary atmospheric pressure. As the air was withdrawn, the sound became more feeble, until, when a vacuum was produced, it ceased, and instead of it there shone a clear, bright light, sparkling like pearls, from the leaves of the condenser. It was not like the pale and vague light of the Geissler tubes, but something, he says, quite different—sharp and distinct; a condensed light.

ELECTRIC DISCHARGES FROM ANIMALS.—Touching the electric brush discharges which sometimes take place from the hair and fingers of men, and the coats of animals, as well as the leaves of trees, a recent note by M. Amat to the French Academy, mentions some curious facts which came under his observation in Algeria, in 1876, between Djelfa and Laghouat, among the Atlas Mountains. He says that he has frequently drawn large sparks from the hair of his horse by means of his pocket comb. The best results were obtained in dry weather, in the evening between 7 and 9 P.M. If the hair was a little moist, or the sky cloudy, no sparks or cracklings could be got. Animals, and especially horses, present in a higher degree than man the power of exhibiting these discharges. Travellers on the high plateaus of Central America have remarked that the coats of their horses discharge sparks under the brush or currycomb; and in South Algeria it is common to see the hairs of the tail so much alive with the electric forces, that they diverge from the center. On stroking the tail by hand, distinct crackling sounds may be heard, especially during the day. One reason why man accumulates less electricity than the horse, is perhaps that the horse is better insulated on his horny hoofs.

INFLUENCE OF PRESSURE ON THE PHYSICAL STATE OF BODIES.—Dr. Thomas Carnelly, in investigating the boiling points of various substances under low pressures, has observed that the liquefaction of solids requires, besides a certain temperature, also a certain pressure, which he proposes to call the "critical pressure"; and after a certain pressure has been reached, the liquefaction of the substance depends solely on the superincumbent pressure. If the pressure is kept below its "critical pressure," no amount of heat applied to it will liquify it. By maintaining a pressure below 4.6 mm. (=.18 inches) of mercury—that is, the tension of aqueous vapor at the freezing point of water, Mr. Carnelly was able to keep water frozen in a vessel so hot that it would burn the hand. Other substances besides water behaved in a similar manner. By increasing the pressure, the substances at once liquefy.

DECOMPOSITION OF STEAM BY MAGNESIUM.—Dr. Henry Leffmann, of Philadelphia, proposes a modification of the well-known chemical experiment of decomposing steam by highly heated iron. He proposes to substitute magnesium for the iron. By this substitution the operation may be conducted in a glass tube, in which the process may be made visible to an audience or class. The action is described as being very energetic, the magnesium taking fire and burning brilliantly. From the foregoing, it would appear that the modification proposed by Dr. Leffmann would make an attractive and instructive lecture experiment.

What Civilization Owes to Science.

We give in the following the concluding portions of a lecture bearing on the above theme, which was lately delivered by the editor of this journal before the Philosophical Society of West Chester, Pa.

And now in conclusion, let me add a few thoughts upon another subject of paramount importance that is intimately bound up with that which we have been considering. I refer to the influences which the progress that I have predicted, will have upon the social and moral condition of our descendants who will have the good fortune to live in the enjoyment of their full fruition. For, as ignorance and poverty beget vice and degradation as naturally as water seeks its level, so with equal certainty does the amelioration of the physical well being of mankind beget their opposites.

As comparison is one of the most effective modes of illustration, I shall ask you to invoke the aid of your imaginations in picturing the contrast between the present state of things and the almost inconceivably degraded social conditions of a few centuries ago, for only by such comparison will we be able to infer by analogy the magnitude of the benefits that future generations of men will enjoy from the onward march of science. Let us take, for example, a glance at the social condition of the cities of London and Paris at the time of the Reformation, as it has been graphically pictured by Dr. Draper. In Paris and London the houses were of wood, daubed with clay and thatched with straw or reeds. They had no windows, and, until the invention of the saw-mill, very few had wooden floors. The luxury of a carpet was unknown; some straw scattered on the floor supplied its place. There were no chimneys; the smoke of the ill-fed, cheerless fire escaped through a hole in the roof. In such habitations there was scarcely any protection against the weather. No attempt was made at drainage, but the putrefying garbage and rubbish were simply thrown out of the door. Men, women and children slept in the same apartment; not infrequently domestic animals were their companions. In such a confusion of the family, it was impossible that modesty or morality could be maintained. The bed was usually a bag of straw, and a wooden log served as a pillow. Personal cleanliness was entirely unknown; great officers of state, even dignitaries so high as the Archbishop of Canterbury, swarmed with vermin. To conceal personal impurity perfumes were necessarily profusely used. The citizen clothed himself in leather, a garment, which, with its ever accumulating impurity, might last for many years. He was considered to be in circumstances of ease if he could procure fresh meat once a week for his dinner. The streets had no sewers, and were without pavements or lamps. After nightfall the shutters were opened and slops unceremoniously thrown down, to the discomfiture of the wayfarer tracking his path through the narrow streets with his dismal lantern in hand.

Shall we then wonder that in the famine of 1030 human flesh was cooked and sold? or that in the famine of 1258 fifteen thousand persons perished of hunger in London? Shall we wonder that in some of the invasions of the plague, the deaths were so frightfully numerous that the living could hardly bury the dead? That in the plague of 1348, which came from the East along the lines of commercial travel, and spread all over Europe, one-third of the population was destroyed? Combine with these facts now their necessary concomitant—a people in a state of abject mental darkness and servility, as pitiful as their physical state was degraded, and the picture will be complete.

To trace the steps by which, in contrast with the state of things just described, the amazing intellectual and social progress has been attained that is evinced by the present order of things, is the task of the philosopher and historian.

I hold that no one who studies this interesting problem, can fail to be convinced that it is to the progress of physical science, the gradual dissemination of correct ideas of the laws of nature and their operations, and especially to the useful application of the knowledge thus acquired, that we owe all that distinguishes our present civilization from the degradation of the Dark Ages.

It is the story of Galileo, Copernicus, Newton, Kepler, Harvey, Franklin, Watt, Arkwright, Stevenson, and the host of other worthies who have rendered the names of the learned academies and societies of Europe and America illustrious; and the fruits of their devotion in the pursuit of knowledge we see about us to-day in the steam engine, the steamship, the cotton-gin, the printing-press, the vast affiliated industries associated with coal and iron and textiles; sanitary engineering with its host of contrivances that have diminished the death rate, and to added years have added the blessings of cleanliness, comfort and decency; scientific agriculture, with its fertilizers and machinery, that has multiplied our harvests by ten and fifty fold; the great advances in physiology, medicine and surgery, that have alleviated the miseries of countless sufferers; the advances in the chemical and allied industries that have given us cheap fire, cheap light, cheap metals, cheap paper, cheap clothing, cheap glass and pottery, and a thousand other necessaries; the newspaper, desseminating information to multitudes of readers; statistical science, with its census reports and other indicators of social laws; photography, the sewing machine, vulcanized rubber, the telegraph and telephone, world's fairs, and the countless other blessings to the human race, that the magnitude of the enumeration has obliged me to leave unmentioned, but which have all to do with the material well-being of humanity, and which exercise a wonderful influence upon our intellectual and social progress. With steam and the telegraph alone, science has revolutionized the world, annihilated time and space, created new industries, multiplied the productive powers of the world a hundred-thousandfold, taken into the cottage of the poor a thousand comforts, and carried the torch of enlightenment and civilization into the remotest quarters of the earth.

That which has been accomplished within the last few hundred years, may justly claim the tribute of our admiration and surprise; but prodigious as this progress may have been, science, like a magnificent river, ever deepening and widening with the contributions of her tributaries, is moving on far and fast, and who that intelligently interprets the signs that are all about us, will venture to affirm that a retrospective glance at *our* civilization from the vantage ground of a few centuries hence may not be dazzled with a picture of progress in comparison with which the one I have feebly endeavored to portray, will appear as the faint flashes of daybreak to the fervid brilliancy of midday.

Corrugated Sheet-Iron Siding.

In continuation of the reference in our December number, to the sheet-iron roofing manufactured by the Iron-Clad Manufacturing Co., of 22 Cliff street, New York, we present a brief account, with illustrations, of a form of sheet-iron siding, intended as a fire-proof lining for the sides of buildings. Of the illustrations, Fig. 1 represents the form of the single sheet, a square 12 × 12 inches, and provided with a parallel series of ridges or corrugations. The method of attachment is shown in Fig. 2, from which it will be seen that the end of each sheet is lapped over the end of the sheet below it about one inch, one set of corrugations fitting into the other, and secured with one row of nails only, about one inch above the lap.

The manufacturers call attention to their claim, that the corrugated sheet-iron siding is especially adapted to large buildings, such, for example, as elevators, by reason of the fact that the mode adopted in attaching it prevents it from being affected by the settling together of the walls.

As a protection against the weather, the manufacturers furnish this siding either calamined or painted, as in the case of their roofing shingles. The advantage of this form of siding as a protection against fire is very obvious.

We refer our readers for further details to the manufacturers.

Meeting of the American Institute of Architects.

Over fifty of the prominent architects of the principal cities of the Eastern States were in attendance upon the fourteenth annual convention of the American Institute of Architects, which was recently held in the Supreme Court Room, Public Building, in Philadelphia. The meeting was called to order by the President of the Institute, Mr. Thomas U. Walter. In his annual address, the President said: "The tendency of the architectural world is decidedly in the direction of originality. We therefore find but little attention paid to the types of building drawn from the works of bygone ages, or to the mannerisms of the more recent past. Progress in the development of the elements of taste and beauty, and the concretion of æsthetic principles with common sense in architectural design, are now everywhere apparent. The responsibilities of architects are greater than they have ever been before; the growing demand of the times in which we live calls for intelligent studies in all that relates to our art, whether it be in the realm of æsthetics, in sciences that relate to construction, in the nature and properties of the materials we use, in the atmosphere that surrounds us, or in the availability of the thousand-and-one useful and ingenious inventions that tend to promote the convenience and completeness of our structures."

Mr. A. J. Bloor, of New York, read an interesting paper on "The Best Method of Solving the Tenement House Problem." After considering the points of security against fire, providing for ventilation and the distribution of light, the essayist took up the subject of drainage and other sanitary appointments. He said: "If the house is built on a wet soil, the cellars and yards should be under-drained with vitrified earthen pipes, in number and of the size rendered necessary by the expected amount of moisture which should discharge into the waste pipe that connects with the street sewer. If neighborhood exigencies permit, there should be a drain running clear around the structure just below and beyond the footing stones, but not touching them, otherwise the drain joints are likely to be opened by the settlement of the walls. The cellar should be hydraulic cemented, and the outside of the foundation wall, up to the water-table or sill course, coated with the same, or with a thick smearing of pitch. Cesspools should be provided for the overflow of the hydrants, and discharged into the main drain. On the score of economy, the preferable place for the water-closets would be in the cellar. The prevention of the deposit of bulky foreign substances in water-closets, as well as of undue accretions of animal sediment

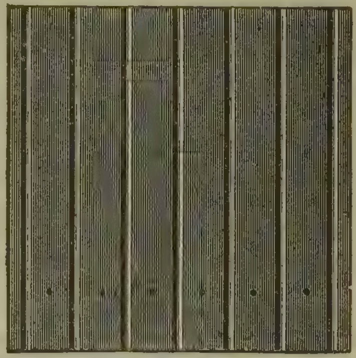


Fig. 1.—Sheet-Iron Siding—Form of Sheet.

and slop grease, is a difficult matter even in the houses of the wealthy, owing to the thoughtlessness of children and servants; and is very much more so in tenement houses, for among ignorant people the impression largely prevails that the casting of anything into a dark hole disposes of it at once for all. The plan submitted also provides for a hopper arrangement for the water-closets to admit of the disposal of the chamber slops, and so preserve the cooking sinks and

Fig. 2.—Mode of Laying the Siding.

atmosphere of the kitchen pure. The traps of every water-closet and sink should be ventilated through pipes of appropriate caliber, to the roof, and soil pipes should be connected with the leaders from the roof, so as to be flushed with every fall of rain. Changes should all be in the direction of additional means for the thorough ventilation of soil pipes in their whole length. It is the lack of a thorough circulation of fresh air through the whole drainage system of our structures, even the costliest, which is turning our houses into hotbeds of diseases generated by foul air, and which are often erroneously attributed to malaria contracted elsewhere."

The essayist closed this portion of his paper by recommending that all the pipes connected with the drainage of the house should be constructed so as to be as easily accessible as the cords and weights of the windows, so that they might be easily and readily repaired whenever accidents occurred.

Invitations were received and accepted to visit the Academy of Music for the purpose of inspecting the system of ventilation in that building.

Mr. George T. Mason, Jr., of Newport, read a paper on "The Practice of American Architects during the Colonial Period;" Mr. Robert Briggs, of Philadelphia, one on "The Ventilation of Audience Rooms;" and Mr. T. M. Clark, of Boston, one on "French Building Laws."

The Melbourne Exhibition.

The Melbourne Exhibition is now in full and successful operation. The British section contains 857 industrial entries, many single entries being of a very large extent. The Italian art collection comprises 429 designs and paintings, and the French 255. Belgium has an entry of 122 works of art; Germany, 139; and Holland, 18. The Australian colonies themselves exhibit to a considerable extent in the fine art section, New South Wales sending 67 entries, Tasmania 15, Queensland 18, New Zealand 79, while Victoria, the colony in which the exhibition is held, contributes 447. In the industrial section, the United States appears as making 364 entries, but some of the objects sent were destroyed by casualty at sea. By a similar accident which overtook some of the English consignments by the "Sorata," only one collection, that of the Kirkstall Forge Company, was totally lost. The Indian exhibition is a large one, there being 320 entries. The industrial exhibition of Victoria itself reaches 1,828 numbers. Western Australia sends vegetables, fruits, and raw materials of various kinds, etc. New South Wales, which held its own exhibition last year, has 297 industrial entries, while New Zealand has 511, Queensland 545, and South Australia 232. After the near Australian colonies, the other British dependencies display, as might be expected, a marked falling off in numbers, Mauritius sending 84 entries; the Straits Settlements, 95; the Cape and Jamaica, 5; Japan has no less than 154; China only 15. On the other hand, some of the European countries have manifested great activity. Germany has 845 entries in the industrial section —only 12 less than the mother country, while France contributes 898, actually more than England; and these numbers do not include the collections of the Ministry of the Interior and of the General, Departmental, Communal, and Penitentiary Administrations (49 numbers). The Italian entry is 618; the Dutch, 71. Switzerland has 50 entries; Russia, Turkey, Sweden, Norway, and Denmark have an insignificant exhibition, and a similar remark applies to Spain, Portugal, and their colonies, or the independent Republics formed from their colonies. The British section is particularly rich in textiles, pottery, and metallurgy.

Production of Local Anæsthesia.—Some experiments made in Germany in the production of local anæsthesia, show that if the hand be immersed for a short time in ice water, severe pain is caused; but no pain is produced on immersing the hand in cold alcohol, not even with the alcohol at a temperature of 5° Cent. Glycerine was found to possess a similar property. Ether excited pain, and quicksilver more acute pain still, causing the speedy withdrawal of the finger when plunged into this liquid at a temperature of 3° C. It was ascertained that, on the finger being held for a long time in alcohol having a temperature of 5° Cent., no pain was experienced, and, although the finger distinctly perceived the faintest touch, sharp pricks gave no pain. This seemed to show that the application of cold alcohol has the effect of depriving the part of the special sensibility of pain, without, however, impairing the delicacy of the general tactile sensation which resides in the superficial integument.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	25 a —
Spruce plank, 2-inch	38 a — 40
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	50 00 a — —
Oak	55 00 a 60 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 10 a — —
Yellow dressed pine flooring	30 00 a 37 50
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale per M.	3 50	a — —
Up Rivers	— —	a — —
Jersey	6 75	a 7 25
Long Island	— —	a — —
Haverstraw Bay	7 50	a 7 75
" " choice	8 00	a — —
Favorite Brands	8 25	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown per M.	10 00 a 11 00
" Dark	11 00 a 12 00
" Red	11 00 a 12 00
Philadelphia	— — a — —
Trenton	21 00 a 22 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	24 50 a — —
" Glengarnock	23 00 a 23 25
" Eglinton	21 50 a — —
" American, No. 1	25 00 a 26 00
" American, No. 2	22 00 a 22 50
" American, forge	20 00 a 21 00
	Store prices. Cash.
Bar, Swedes, ordinary sizes	— 6 a — 6¼
Bar, Swedes, nail-rod	— 6½ a — —

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 00 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 25 a 6 50
*I. X. charcoal, 14x20	8 25 a 8 37½
*I. C. coke, 14x20	5 00 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 75

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7¼ a — 7⅜
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates.

Amherst Freestone, in rough, per cubic foot	— 95 a 1 00
Berlin Freestone, in rough	— 75 a 1 00
Berea Freestone, in rough	— 75 a 1 00
Brown-Stone, Portland, Conn	1 00 a 1 35
Brown Stone, Belleville, N. J	1 00 a 1 35
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Dorchester, N.B., Stone, rough, per foot	— — a 1 00

PAINTS.

*Carmine, American, per lb gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 8¼ a — 9
Lead, white American, pure, dry	— 7¾ a — 8¼
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9½ a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2½ a — 3
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags gold	— 55 a — 57 ½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8¼ a — 9
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 65 a 3 40
Portland (American)	2 25 a 2 50
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 20 a 3 40
Portland (German, Bonner)	2 85 a 3 25
Lime of Teil	2 20 a 2 30
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	— 90 a 1 00

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 00
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	3 50 a 4 00
Nova Scotia, blue	3 50 a 3 75
Calcined, Eastern and city, per bbl	1 25 a — —
Calcined, city casting	1 50 a — —
Calcined, city superfine	1 75 a — —

LIME—PER BARREL.

State, common	— 90 a — —
" finishing	1 15 a — —
Rockland, common, cargo rate	— 90 a — —
" finishing	1 00 a — —
Ground	— 95 a 1 00

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 25
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	25 00 a 50 00
Lignumvitæ, other sizes	10 00 a 20 00

CEDAR.

Cuba, per superficial foot	— 8 a — 11
Mexican, small	— 8 a — 9½
Mexican, large	— 10 a — 11
Florida	— 40 a — 75

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—In the lumber market during the past month there has been no feature of special note. Dealers generally have appeared very well satisfied with the results of the past year's operations and are looking forward to a good trade this year.

In the brick market there has been a strong tone for common hards, with a slow but sure gain on values. The holiday season and the unfavorable weather tended to restrict operations somewhat during the latter part of the month, but this was neutralized by light supplies and a demand to pile away against future wants, which prevented any accumulation afloat. The year closes upon a generally firm and promising market for all holders of stock.

In the lath market a strong feeling has prevailed and verified the predictions and expectations of receivers. Some fair arrivals have taken place since our last, but all were wanted, and with sufficient anxiety to induce an increase upon bids, upon which an advance of ten cents per thousand is established, fixing the selling basis by cargo at $2.10 per thousand. The demand, however, is not yet satisfied, and buyers may be found ready to negotiate, though rather disinclined to agree to the still higher figures asked on the few parcels offering to arrive.

In the lime market trade has been well sustained, and full former prices have remained current on all grades. Supplies have come to hand slowly, and have been exhausted at once, and the demand has been quick enough to make a place for much larger quantities.

In the cement market business has had a firm tone, and generally the supplies available have been moderate, with a pretty good demand current for Rosendale. Foreign grades have been in good demand for the season, and generally reported as retaining a healthy, uniform tone.

In the hardware market there has been scarcely any business doing except on city account, and this has not amounted to much, buyers merely taking some odd invoices to meet an unexpected necessity, etc. Offerings have been fair but not full, the desire being to prevent an increase of accumulation until after the yearly inventory shall have been completed.

In the paint market demand generally has been moderate and uncertain and few parcels have been taken except under force of the most urgent wants. In the majority of cases holders make a showing of fulness, and asking rates are pretty much as before, but for actual sales considerable irregularity has been shown with the turn principally in buyers favor.

In the metal markets American pig has been quite slow of sale on the spot, and only small jobbing parcels have been disposed of. Offerings have also been light, and holders in almost all cases remained firm at full former figures. Scotch pig has shown no change of importance. Demand has been moderate and somewhat uncertain, but no more so than usual at this season, and holders have remained very firm in asking full former rates. Manufactured iron has found more or less neglect, and the tone of the market has been weak and unsettled under strong competition between imported and domestic lots. Domestic pig lead has been selling quite slowly, and mainly in small lots, as wanted for immediate use. Tin in pig has as a rule been in strong hands, and owners have not been anxious to operate, but demand has been moderate and uncertain. Tin plates have sold fairly for immediate, and with greater freedom for future delivery, but offerings have been ample, and the increase of movement has been due as much to better terms offered as anything. Zinc has been in limited demand.

NOVELTIES IN CARPET DESIGNS for the present season are stated to be taking the shape of rather larger patterns than have been in vogue hitherto. The small patterns are very nice for small rooms, but they do not give sufficient scope to the designer, and a persistent effort is now being made to return to rather larger styles, allowing more room for decorative filling and expansive treatment.

ODE TO AN OLD BOILER.

Patch her up, the dear old boiler,
She has boiled of years a score;
'Twould be cruel now to leave her—
Where she ought to be—on shore
At the junk shop.

Patch her up, the cracks are sizzing,
In Providence we put our trust;
Flags are waving, music playing,
Surely she will never bust.
Bang! whang! pop!
Well! really that's the fust
Time she ever bust!

Adulterations of Food.

Abstract of a paper read before the meeting of the American Social Science Association, at Saratoga, by Professor S. W. Johnson.

(*Continued from Page* 282, *December Number*, 1880.)

Next to bread, milk ranks in importance on the list of foods that are subject to adulteration. We have it on good authority that milk, after being robbed of its cream and diluted with water to cheapen it, has been mixed with sugar to sweeten it, with salt to develop its flavor, with annatto and turmeric to improve its color, with soda and chalk to keep it from souring, with gum, dextrin, emulsion of hempseed, boiled starch, and even pulverized brains to thicken it.

The most common adulteration of milk is by the addition of water, and where there is no milk inspection, this, and the removal of cream, are the only usual modes of tampering with it, unless soda is added to keep sweet what otherwise might sour before it could be disposed of.

In 1869 and 1870, Prof. Chandler, now President of the Board of Health of New York, directed examinations of five hundred and fifty samples of the milk of that city. The only adulteration that could be detected was water. In forty-five cases milk was seized by the police at the moment when it was undergoing the process of dilution. By chemical analysis, or by the use of the lactometer (lactodensimeter), the quantity of water added was ascertained, and the average amount found to be over 26 per cent, or, for every three quarts of milk one quart of water was sold. It was estimated that in this way forty million quarts of water were annually peddled out at the average rate of 10 cents per quart, making "business" to the amount of $4,000,000 per year, or $12,000 per day.

Some one has stated, I know not how correctly, that the number of cows that not long since supplied milk to London was not enough to give to each inhabitant of that metropolis more than a tablespoonful of pure milk daily. In Boston, during the last winter, the legislative committee on Agriculture had a hearing on the matter of milk adulteration. The State assayer was present with two samples of milk, one genuine, the other diluted with 25 per cent of water and colored with a trace of annatto. In appearance both were equally good, and both bore the same test by the lactometer—*i. e.*, doubtless the specific gravity of the falsified sample had been first increased by removing the lighter cream and then lowering to the standard of pure milk by adding heavier water.

This refinement in adulteration, which originated years ago in Europe, is the result of legislative action that has made tampering with milk a misdemeanor, but has not provided adequate methods for detecting evasions of the law, or sufficient punishment for the offenders, but has the effect to put dishonest dealers on their guard and to make them more careful to conceal their misdeeds.

From adulterated milk we naturally turn to adulterated butter. Curiously enough, the most common adulterant of milk—namely, water, is largely employed in sophisticating butter. Honest butter rarely contains more than 6 to 10 per cent of water, but the "butter factors," it is said, understand how to increase the proportion up to 30 and even 40 per cent. Salt, which should exist in good butter to the extent of not more than 1½ to 3 per cent, is worked in to the amount of 6, 8 or more per cent. Boiled starch has also been employed to "extend" very cheap butter. Butter is not infrequently sophisticated by admixture of cheaper animal fats, namely, tallow and lard.

There has recently grown up among us a new industry, which is of itself perfectly legitimate, but which readily "lends itself" in materials, if not in morals, to the business of butter adulteration. I refer to the so-called oleomargarine manufacture. Oleomargarine is simply beef tallow deprived of a portion of the more firm and infusible fats, and thus made to approach the consistency of butter, in further imitation of which it is mixed with milk and annatto, and churned, the result being a product, that, when made in a cleanly manner, is a fair substitute for butter for all cooking purposes, and is superior to cheap butter for any purpose. Sold as oleomargarine, this article is well enough, being entirely wholesome and nutritious, and much cheaper than good butter. In England, however, it is known as butternil, and in conformity with the suggestions of this significant designation, it enters into not a little of the butter of commerce, or docked of the last syllable of its name, is sold as butter pure and simple. It is stated that oleomargarine, or mixtures in which it was the predominating ingredient, have passed as genuine butter, and borne off high prizes in some of our recent dairy fairs. I cannot vouch for the truth of this statement, but do not regard it as altogether improbable.

In the manufacture of cheese, it is said that boiled potatoes, boiled beans and oleomargarine are sometimes used to make weight, Venetian red and red chalk to color the rind, and sulphate of copper, arsenic and corrosive sublimate are employed in minute quantities to prevent the lodgment of parasitic insects.

Lard, a substance used in every kitchen, has sometimes been found to contain 20 to 30 per cent of boiled starch, with 2 to 3 per cent of alum and 1 per cent of quick lime. The starch is simply a vehicle for incorporating water with the lard; the lime and alum are probably used to prevent the water separating from the mixture and to hinder the growth of mold.

Of the great food staples, sugar is one with regard to which some alarm has recently been raised. It has been widely published that our sugars are largely diluted, cheapened, and even poisoned, by mixture with glucose and injurious metals. In respect to white granulated sugars, this is, I believe, neither true nor likely to be so. Pulverized white and fine grained brown sugars are liable to be adulterated with glucose, but I am not positive that this falsification has been much practiced.

(*To be Continued Next Month.*)

Brazil's Inter-Continental Exhibition.

The important and valuable results to our export trade from the Centennial Exhibition have led to combined efforts in various directions for its continued extension and increase. The recent establishment of a permanent exhibition in Rio de Janerio, for the exclusive sale of the products and goods of North and South America, is most opportune, especially to the manufacturers of New England. This exhibition is in the hands of a well organized society, composed of some of the leading men in the Empire, its president being Count d'Eu, the son-in-law of the Emperor. A concession of land, admirably located in the city of Rio, has been granted by the government, and in the meantime (during the erection of the exhibition palace) suitable buildings have been supplied by the government for present purposes. These rooms are already open, and the exhibits from Brazil and other South American States are being arranged.

As the special object of this exhibition is to secure a large increase in trade and commerce between Brazil and the United States, most favorable arrangements have been made. The society pay all expenses—freight, insurance, etc., and the exhibition building, being a bonded warehouse, there are no duties to pay. It is proposed by the society to make sales of all goods as rapidly as possible, and return accounts with remittances by each monthly steamer, deducting a commission of five per cent. To effectually carry out arrangements in the United States, Mr. John C. Kip Hopper, formerly a merchant in Rio, and since connected with the U. S. Treasury Department, has been selected as resident director for the United States, offices at No. 135 Broadway, New York.

The Cotton Worm.

Before the American Association for the Advancement of Science, Prof. Riley, of Washington, read a paper on the recent practical results of the cotton worm inquiry by the United States Entomological Commission. He stated that the cotton worm of the South is a small, looping caterpillar, the young or larvæ of a moth, known to science as *Aletia argillacea.* While there are many other insects injuriously affecting the cotton plant, this is the worst of all, and careful statistics show that the people of the South have suffered an annual loss since the war of about $15,000,000 from its ravages. On behalf of the United States Entomological Commission, Prof. Riley has had charge of the investigation of this insect for the past two years. Some of the results are very interesting to naturalists; but it was his object in the present paper to indicate some of the more recent results of practical value to the planter. Up to the year 1872, the planter was at the mercy of this insect, as no attempt had been made to do anything more than to kill a few of the parent moths by attracting them to lamps, fires and poisoned sweets. Unfortunately, this was always done either in summer, when the worms were abundant, or in autumn, when the moths swarmed. The results were unsatisfactory, first, because of the difficulty in getting the coöperation of all persons in a given neighborhood, and second, because most of the moths that swarm in the fall of the year are destined to perish. The season when the moths can be most advantageously caught and killed is in the early spring, for, though only a few may then be captured, every one destroyed at that season helps greatly to prevent subsequent injury. Since 1872, when he first suggested the use of Paris green, or, more practically, since 1873, this mineral has been used with great satisfaction to destroy the worm. Last year the Commission introduced as a substitute a refuse material obtained in the manufacture of aniline colors, and it has given such satisfaction that the demand cannot be supplied. It costs only one-fifth as much as Paris green, and protects pound for pound twice as large an area. With it planters may protect their fields at a nominal first cost of five cents per acre. All these substances are poisons, and have to be used with the greatest care. In other investigations and experiments, Prof. Riley had discovered that pyrethrum roseum, the powder of which he had found a year ago, was wonderfully effective in destroying the worm.

COMPARATIVE LONGEVITY.—Herr Max Waldstein, of the statistical department at Vienna, has published a pamphlet giving some curious statistics as to the ages of some of the inhabitants of Austria and other parts of Europe. He says that the number of people in Europe who are upward of ninety years old is 102,831, of whom 60,303 are women. Of those who are over 100 years of age there are 241 women and 161 men in Italy, 229 women and 183 men in Austria, and 526 women and 624 men in Hungary. There are in Austria, 1,508,359 persons over sixty years of age, comprising 7.5 per cent of the whole population. It is found that the percentage of old people is much higher among the Germans than among the Slavs. In the German provinces of Upper Austria and Salzburg it is 11.5, while in Galacia it is only 4. In Hungary there are more old men than old women, which is explained by the fact that the excess of women over men is less in Hungary than in other countries. According to Herr Waldstein, there are in America 100 women and 86 men who are 100 years old, 41 women and 37 men who are 101, and 78 women and 60 men who are upwards of 104 years of age.

Home Department.

Success.

Emerson says: Self-trust is the first secret of success—the belief that, if you are here, the authorities of the universe put you here, and for cause, or with some task strictly appointed you in your constitution, and so long as you work at that you are well and successful. It by no means consists in rushing prematurely to a showy feat that shall catch the eye and satisfy spectators. It is enough if you work in the right direction. So far from the performance being the real success, it is clear that the success was much earlier than that; namely, when all the feats that make our civility were the thoughts of good heads. The fame of each discovery rightly attaches to the mind that made the formula which contains all the details, and not to the manufacturers who now make their gain by it; although the mob uniformly cheers the publisher, and not the inventor. It is the dullness of the multitude that they cannot see the house in the ground-plan; the working in the model of the projector. Whilst it is a thought, though it was a new fuel, or a new food, or the creation of agriculture, it is cried down; it is a chimera; but when it is a fact, and comes in the shape of eight per cent, ten per cent, a hundred per cent, they cry, "It is the voice of God," Horatio Greenough, the sculptor, said to me of Robert Fulton's visit to Paris: "Fulton knocked at the door of Napoleon with steam, and was rejected, and Napoleon lived long enough to know that he had excluded a greater power than his own." Is there no loving of knowledge, and of art, and of our design, for itself alone? Can not we please ourselves with performing our work, or gaining truth and power, without being praised for it? I gain my point, I gain all points, if I can reach my companion with any statement which teaches him his own worth. The sum of wisdom is, that the time is never lost that is devoted to work. The good workman never says, "There, that will do;" but, "There, that is it; try it, and come again, it will last always." If the artist, in whatever art, is well at work on his own design, it signifies little that he does not yet find orders or customers. I pronounce that young man happy who is content with having acquired the skill which he had aimed at, and waits willingly when the occasion of making it appreciated shall arrive, knowing well that it will not loiter. The time your rival spends in dressing up his work for effect, hastily and for the market, you spend in study and experiments toward real knowledge and efficiency. He has thereby sold his picture or machine, or won the prize, or got the appointment; but you have raised yourself into a higher school of art, and a few years will show the advantage of the real master over the short popularity of the showman. I know it is a nice point to discriminate this self-trust, which is the pledge of all mental vigor and performance, from the disease to which it is allied—the exaggeration of the part which we can play; yet they are two things.

Integrity in Business.

No merchant, however persistent and shrewd he may be in his commercial operations, can build up a great and prosperous business without integrity. Integrity is the link that holds the great financial world together; it is the basis upon which all great commercial operations are founded. When business men lose faith in one another, mercantile interests are immediately affected, industries become paralyzed, and the great laboring world complains of poverty, of hunger and hard times. The great rush and struggle to win immediate wealth, bankrupts many a reputation and ingloriously ends many a brilliant business career. When men undertake and promise to perform certain impossible things; when they engage to pay certain amounts, when due, well knowing at the time that they cannot meet their obligations at maturity; when they borrow money without any serious intention of repaying it, they are not only taking a course that will eventually result in disaster and distress to themselves, but they are bringing discredit and dishonor upon the whole trade or branch of industry they represent. They are shaking the commercial confidence and trust of the business community with which they are associated. A merchant cannot too much appreciate the value of business integrity and honor. They give him social as well as business standing. They give weight to his counsel and respectability to his name.

The "Splendid" Parlor Stove.

We show in the accompanying illustration the external appearance of an elegant stove, well known to many of our readers by the trade name of the "Splendid" parlor stove, by which its makers designate it. These stoves, with others of substantially the same general internal construction, have been manufactured for a number of years by the present makers, and of

The "Splendid" Parlor Stove.

late have been improved in appearance by numerous additions of a decorative character, which, without detracting from their details or general design, add to their general attractiveness.

The "Splendid" is furnished with a suspended, sectional fire-pot, each section being held in place by a lug and pin, by which arrangement the fire-pot may be removed and replaced by sections, or the entire fire-pot may be removed through the mica-light doors, without removing any other portion of the stove. The "Splendid" is provided with a vibrating grate with open center, and a supplementary sliding grate beneath the vibrating grate, the frame of the former being provided with wheels upon which the latter rests. When the vibrating grate is moved, the ashes and clinkers collect on the sliding grate, which, when drawn out, deposits them in the ash-pan below. The revolving top cover to the magazine fits closely, and is compact and practical in use.

One of the peculiarities of the "Splendid" is an attachment by which it is made to act as a heater, the air being drawn into an annular space between the magazine casing and the outside cylinder of the stove, and thence passed, by means of a hot-air flue, into an upper apartment. The heat is still further economized by passing the smoke pipe through the hot-air pipe for a portion of its length, by which it parts with considerable heat which would otherwise be wasted. The base of the stove is also provided with a recent improvement which adds to its value, being furnished with several air passages through which a current of heated air is constantly discharged into the apartment. This arrangement utilizes the accumulation of heat at the base of the stove, simply and effectively.

The "Splendid" parlor stove shown in our engraving is seen to be provided with a compact boiling attachment, which adds to its utility while not detracting from its elegance. An ornamental swing cover conceals the boiler hole when not in use, and forms a convenient warming-shelf when turned to one side.

These stoves, we are informed, have been adopted for the Sixth avenue stations of the elevated railroad in this city. These stoves are manufactured by Messrs. Fuller, Warren & Co., of Troy, N. Y., and the New York agent for these and other goods of the same maker, is Mr. G. G. Hallett, of 236 Water street.

Observation.

No line can be drawn, says Huxley, between common knowledge of things and scientific knowledge, nor between common reasoning and scientific reasoning. In strictness, all accurate knowledge is science, and all exact reasoning is scientific reasoning. The method of observation and experiment, in which such great results are obtained in science, is identically the same as that which is employed by every one every day of his life, but refined and rendered precise. If a child acquires a new toy, he observes its character and experiments upon its properties; and we are all constantly making observations and experiments upon one thing or another. But those who have never tried to observe accurately, will be surprised to find how difficult a business it is. There is not one person in a hundred who can describe the commonest occurrence with even an approach to accuracy. That is to say, either he will omit something that did occur, and which is of importance, or he will imply or suggest the occurrence of something which he did not actually observe, but which he unconsciously infers must have happened. When two truthful witnesses contradict one another in a court of justice, it usually turns out that one or the other, or sometimes both, are confounding their inferences from what they saw with that which they actually saw. A swears that B picked his pocket. It turns out that all A knows is that he felt a hand in his pocket when B was close to him; and that B was not the thief, but C, whom he did not observe. Untrained observers mix up together their inferences from what they see with that which they actually see in the most wonderful way; and even experienced and careful observers are in constant danger of falling into the same error. Scientific observation is such as is full, precise and free from unconscious inference.

Restoring Respiration.—Professor Fort has presented the question of premature interments to the French Academy, in a paper on artificial respiration. One of the facts he mentions, is that he was enabled to restore to life a child three years old by practicing artificial respiration on it some four hours, commencing three hours and a half after apparent death. A similar case is reported by Dr. Fournol, of Builoncourt, who reanimated a nearly drowned person after four hours of artificial respiration. This person had been in the water ten minutes, and the doctor arrived one hour after asphyxia. Professor Fort advocates also the utility of artificial respiration in order to eliminate the poison from the lungs and glands. The length of time it is desirable to practice artificial respiration in any case of apparent death from asphyxia may be said to be several hours.

A New System of Apprenticeship.

We gather from the *Iron Age* that a system of apprenticeship, in some respects new, has been adopted by Messrs. Richards & Dole, machinists, of Springfield, Mass. It is intended to combine the thoroughly practical education of the shop with the theoretical education of the school; or, in other words, it is an industrial school in which the most time will be given to practice, instead of theory. They propose to require of the apprentice fifty-eight hours a week of work in the shop and nine hours of study. The term of apprenticeship for those beginning to learn a trade, who are under twenty years of age, is to be six years, in which time, under this system, it is believed an apprentice will be qualified to rank with the best journeyman, and to earn the same wages. Those who are over twenty years of age are allowed to finish their apprenticeship in five years, and those who have worked in a shop are advanced according to proficiency. The beginner is first put to drawing from sketches, and then takes up projection and diagrams, and advances regularly according to his ability. It is believed that in this way one year will qualify him as well to work from drawings as four or five years ordinarily. All applicants are taken for from four to twelve weeks on trial, and if not satisfactory are then dismissed. For the first year's labor five cents per hour is paid to those under eighteen, six cents to those who are eighteen, and seven cents to those who are twenty and upward; for the next years the rates are advanced to six, eight, ten, eleven and twelve cents. The firm also pay two cents per hour additional into a reserve fund, which is paid to those apprentices who finish their full term of service; for the six years this amounts to $400.

The scheme in this shop grew out of the difficulty experienced in getting thoroughly qualified machinists, and is an attempt to solve again the old problem of how to continue the system of apprenticeship, now largely fallen into disuse. It is stated that this firm already have more applicants than they can accept. The scheme certainly seems worthy of a trial. We have but little sympathy in many cases with the lament over the decadence of the apprentice system. The introduction of machinery, and the consequent subdivision of labor, have made it unnecessary in many trades. In some trades, however, there can not be such a subdivision nor such machinery as will do away with the necessity for a large proportion of skilled, thoroughly educated mechanics, and the machinist's trade is one of these. The scheme we have described above certainly seems well calculated to produce workmen not only competent for the ordinary routine of shop work, but competent to design and oversee the execution of work.

Pneumatic Tubes Supersede Cash Boys.

The incessant calls for cash boys, which formerly made shopping in our larger establishments so wearisome, if not exasperating, were silenced and the terrors of shoppers greatly mitigated by the introduction of electric calls. An enterprising Philadelphian, Mr. John Wanamaker, has gone a step further, and displaced the dusty skurrying of cash boys and cash girls by a system of pneumatic tubes. Under the new system, an inspector and wrapper is stationed at each counter, who will receive with the money and goods the seller's check. While goods are being wrapped up, the cash, with the proper vouchers, will be transmitted to a centrally located cashier, who will return the change through the proper tube. There are two such tubes leading from each counter to the cashier's inclosure. One of the tubes is to carry the money to the cashier, and the other is to return the change and accompanying check to the counter again. The "carriers" which work inside of the tubes are little cylindrical boxes of sheet steel, lined with green baize, and protected at each end by diminutive felt cushions. Each carrier is of the exact diameter of a silver dollar, and is capable of holding thirty of the latter pieces, or a much larger sum. By means of a steam engine and exhaust pump in the cellar, with proper attachments leading therefrom, the air is being constantly exhausted at the cashier's end of the tube and at the counter end of the tube of each pair; and when a "carrier" is placed in the mouth of either tube, it is immediately drawn to the other end, and is there delivered automatically by an apparatus devised for that purpose. This system not only saves time and noise, but the wages of an army of boys or girls, besides discharging a large amount of fresh air into the building, greatly improving the ventilation.

Drying Fruits by Evaporation.

It is affirmed that the industry of drying fruits by the new evaporating process, has of late years grown to such large proportions that it is becoming fairly entitled to take rank in our domestic and foreign trade with staple productions. In explaining this very rapid growth of the dried fruit industry, it is stated that the evaporating process as at present conducted, produces an article so far superior to that made by the old sun-drying process, that a large demand has sprung up in all directions, especially in Europe, and is steadily on the increase.

So rapid has been the growth of this comparatively new branch of trade, and so decided the advance in prices, that considerable capital has lately been attracted to the industry, and many new evaporating mills have been erected during the past summer in those portions of our apple-growing regions that are too remote from the market to warrant shipment of the fruit in its natural state.

By the new process, apples from the tree are converted, within seven hours, into merchantable goods, having almost the whiteness of snow-flakes, and vastly superior in every respect to the product made by the old sun-drying method formerly in vogue.

Miscellaneous and Advertising.

The George Place Machinery Agency, of 121 Chambers street, this city, have always on hand a large line of new and second-hand machinery of every description.

Sturtevant's blowers and exhaust fans are meeting with a constantly increasing sale, and the works of B. F. Sturtevant, the manufacturer, at Jamaica Plain, Mass., have been taxed to their utmost capacity lately to turn out orders in hand.

John A. Roebling's Sons & Co., of Trenton, N. J., have shipped, for use in building the Brooklyn bridge, four of the largest steel wire ropes ever made in this country, each being 1,550 feet long and 3 inches thick, and their united weight exceeding 50 tons.

An impression prevails among some mechanics that chilled iron cannot be turned in a lathe, as other metal can, but this is erroneous; with proper appliances chilled is as easily turned as soft iron. Slow speed and wide-faced tools, like those used for turning brass, are employed with satisfactory results.

Prof. T. Sterry Hunt, estimating the production of pig iron in this country during the past year at 4,000,000 tons, expresses the belief that the full realization of the country's possibilities in iron manufacture will not be attained until iron shall be found side by side with the coal and limestone needed for its manufacture. From his experience in the valley of Hocking, in Ohio, he is of the opinion that that section will be the main place of supply of both pig iron and steel, the ore, coal, and lime being found there in close proximity.

Mr. C. V. Riley, late entomologist to the Department of Agriculture, maintains that the army worm in the latitude of St. Louis develops four generations annually; that its common mode of hibernating is not in the egg or chrysalis, but in the larva state, and that the injurious brood is that which succeeds the hibernating one, or, in other words, the progeny of the moths of the hibernating larvæ.

One of the most compact, durable and economical engines in the market is the Sherrill air engine. This engine has steadily been making its way in favor, and we commend it to the attention of those requiring power for hoisting and other similar uses. This engine requires no engineer—an item of no small saving of expense—and its extensive adoption, therefore, has been a natural recognition of its value as an efficient and economical motor.

After five years of trouble, attended with frequent delays and accidents, the telescopic elevators originally put in the New York Post Office, at a cost of about $40,000, have been removed, and Otis Bros. & Co.'s standard hydraulic elevators have been substituted, at a cost of less than $20,000. The first of the new machines has been started on the Broadway pavilion, and will run regularly hereafter. The new Otis elevators will lift 3,500 pounds at a speed of 250 feet per minute, with a water pressure of 52 pounds, while the old machines required 300 pounds pressure to move the cars 75 feet per minute. The cost of running the new machines will be about one-fourth that of the old ones, to say nothing of the saving in repairs.

Design for Cottage Costing $1,800.

On the opposite page we present the design of a picturesque, cosy cottage, in which the architect has endeavored to embody features varying from the common styles so much in use, without materially increasing the expense. The style employed here is one which is much in vogue in England, with a touch of Norman here and there relieving the heavy dullness which the English style possesses to a certain extent.

The exterior is clapboarded up to the ceiling line of the first floor; the second floor of the house sets over on brackets 6 inches. This part is shingled with ornamental shingles, over which a series of false framing is put. That portion of the front which projects to the face line of the verandah is treated in like manner. By referring to the design, it will be seen that the roof starts five feet above the level of the second floor. The whole roof, as that also of the verandah, is shingled. A verandah runs to the whole frontage of the house. The exterior is to be painted a deep olive-green, with chamfers and window sash picked out with Indian-red or dark-brown.

Entering a spacious hall, on either side is the parlor and dining-room, and in front of us an ample stairway, a feature of the latter being handsome turned newel posts which rise to the ceiling.

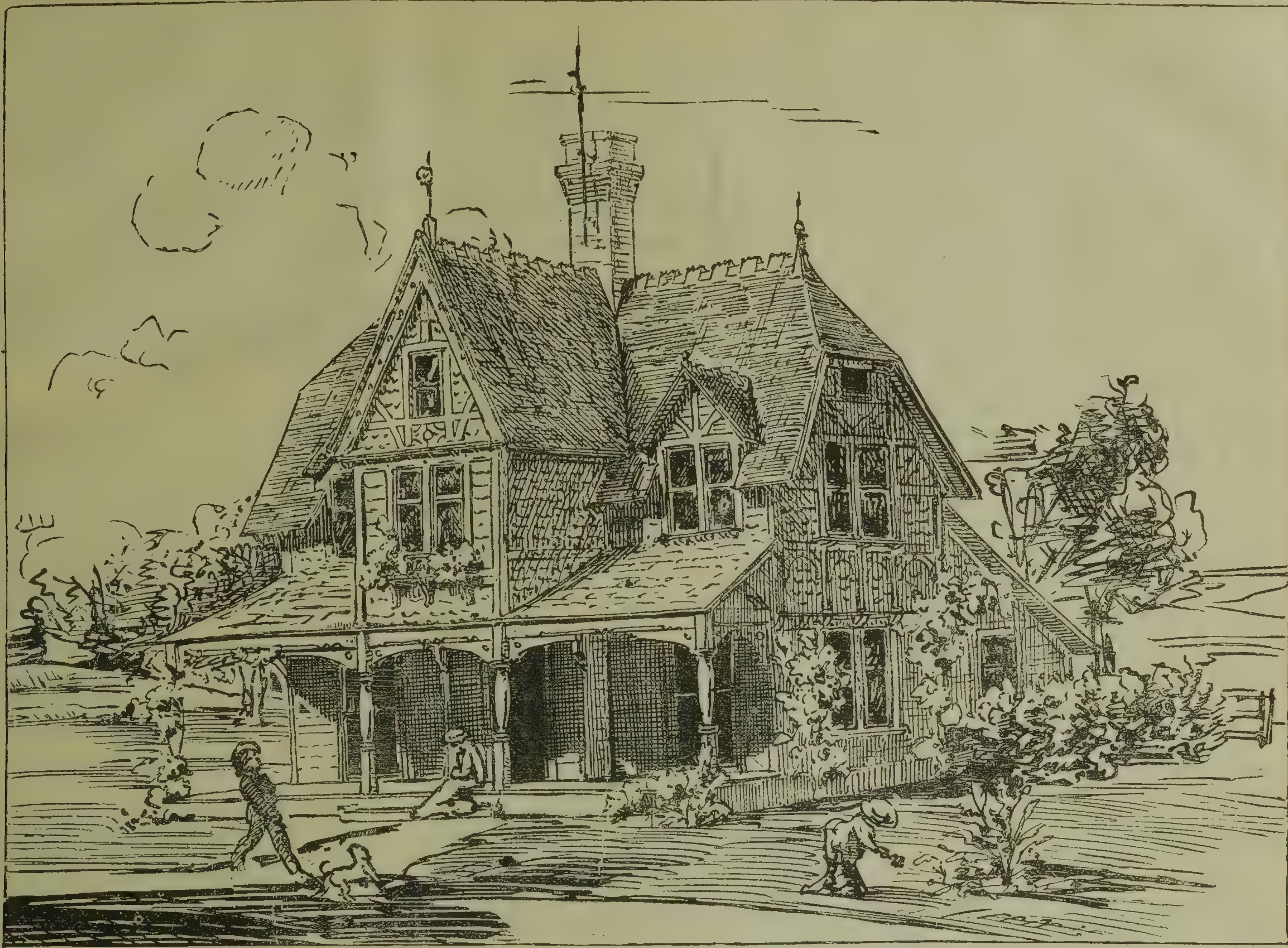
Referring to the ground-plan, it will be seen that the first floor consists of a parlor with a square bay-window, dining-room, kitchen and store-room pantry, which is back of the parlor. From the kitchen or hall we have access to the cellar, which is of the size of the house. The dining-room and kitchen have large closets. The kitchen, which is an L to the main house, is fitted up with a sink, water and china dresser.

Ascending the stairs, we come to the second floor, in the front of which we have the receiving-room, which projects to the face-line of the verandah. On either side are two large bedrooms, one of which has a boudoir or dressing-room attached. On this floor is also a small bedroom, with closet. From this floor we reach the attic, which has one room, the balance to be used for storage purposes.

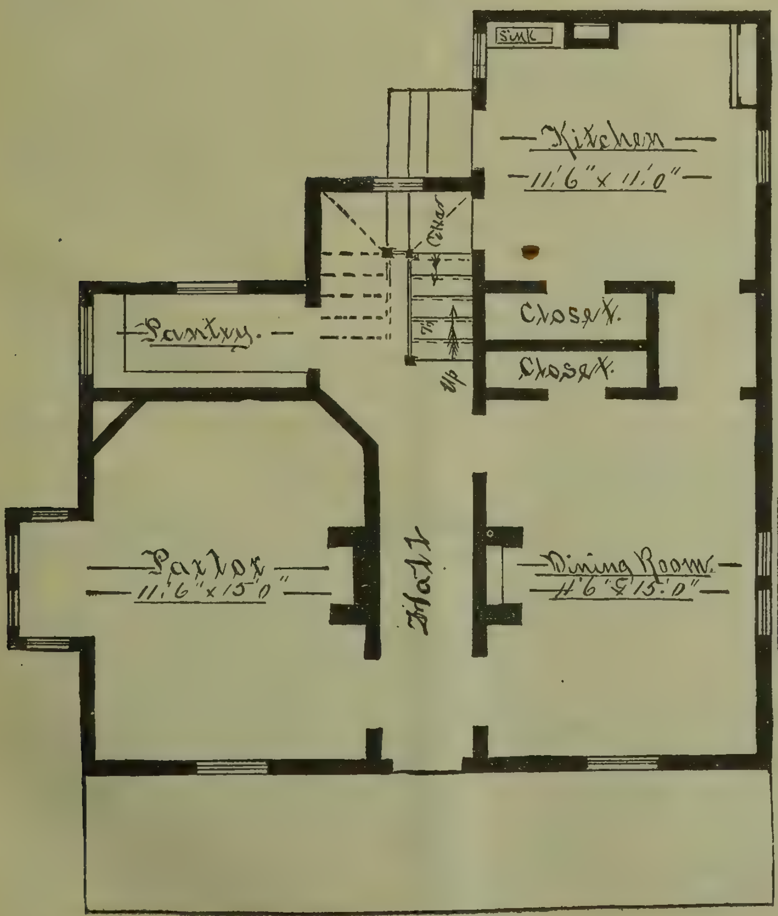
The two chimneys are drawn together in the attic, piercing the roof in the center. A neat cresting to the ridges of the roof gives a finished, picturesque appearance.

The architect is R. Rosenstock, of 215 West 132d street, New York, who will cheerfully furnish further information relative to this design.

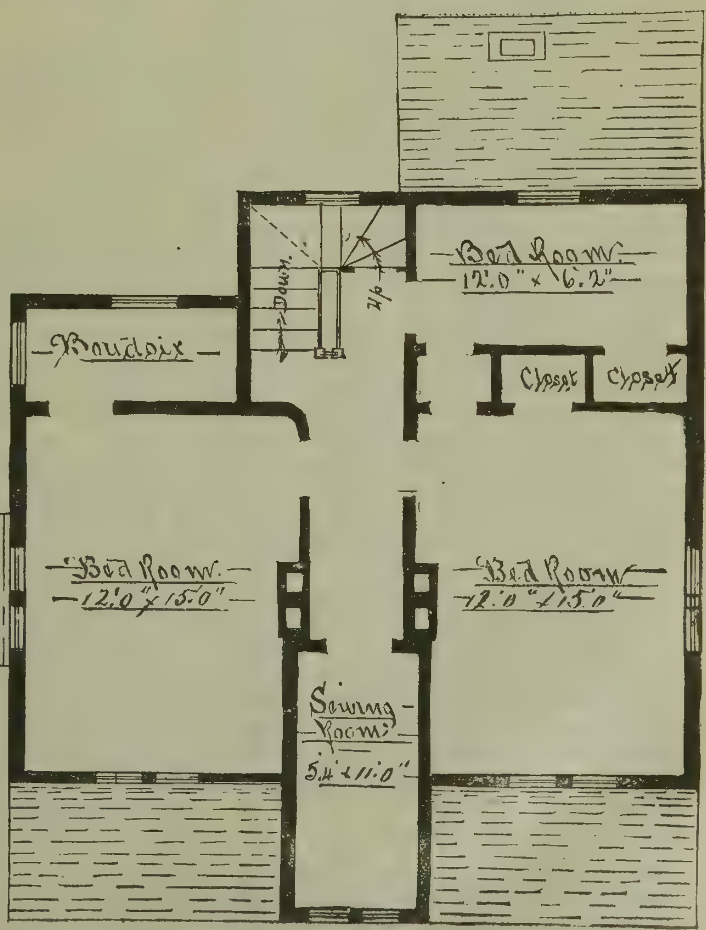
Under favorable circumstances, this cottage can be erected for $1,800.



DESIGN FOR COTTAGE, COSTING $1,800.



Plan of First Floor.



Plan of Second Floor.

The Leather Industry of Philadelphia.

One of the oldest of the staple industries of Philadelphia is the manufacture of morocco leather, which began early in the present century, and was an outgrowth of the East India trade that once distinguished that port, and continued fitfully until 1861. The morocco leather manufacture, however, grew steadily, and is now more prosperous than ever before. There are thirty establishments, says the *Public Ledger*, making goat-skin morocco to the value of $5,056,000 for the last year, as compared with twenty-three in in 1870, then producing $2,307,113 in value. The improvement effected by the introduction of steam machinery has given most of this increase, and the demand for fine leather in shoe manufacture takes all that the factories can produce. A few cases have been sent to foreign markets, but it is not a regular trade, as the export of sole leather has become. More than half the supply of sumac, the chief tanning material, is now produced in Virginia; formerly it was all brought from Sicily.

Next to the morocco manufacture is that of calf-kid and glove-kid, nine factories producing $1,050,000 in value, as compared with $574,043 in 1870. A still larger product is that of colored and fancy leathers, bindings, and linings, chiefly of sheepskin, fifteen establishments producing $1,500,000 in value, as compared with $1,133,568 in 1870. The tanning of heavy leather, sole and upper, has declined, and many of the old yard tanneries have disappeared. But six or seven remain, producing $314,000 in value, as compared with $523,000 in 1870. A large industry remains in currying and preparing leather, although this has declined under the competition of the great steam tanneries of the interior of the State. The produce of about twenty of those tanneries is regularly sold in Philadelphia, one half of it for export to foreign countries. The value so handled is about $6,000,000, and is increasing.

The only feature of the old order of things remaining is the importation of French and Belgian calf skins, which continues at about $750,000 in value yearly, although in the manufacture of calf-kid and like leathers here, the Alsatian and Belgian workmen, transplanted bodily to Philadelphia, give to Canal and St. John streets the air and flavor of the most ancient city of the continent. The only thing lacking, it is said, is time. The continental tanner has months or years before him without limit, whereas time with us is cut off at both ends, and the leather must be out of the tannery in a month. So Philadelphia brings into North Third street every year half a million dollars' worth of the best products of the North of France and adjacent Germany, leaving the poorest for Europeans to wear, because our bootmakers will have the best of French calf skins, or none at all.

In manufactures of leather, including every form of cut leathers in belting, bands, harness, straps, etc., the industry is conducted with great activity. Belting is made for export, and the clean and perfectly finished belts of Pennsylvania leather are now driving machinery in England and Scotland, in Sweden, and in Australia. Even the great factories of Mulhouse would have procured 46-inch belts here if they could, but in France the importation of manufactures of leather is prohibited.

In leather strictly, embracing none but finished forms, the total value of that manufactured for the past year is $8,000,000, an increase of 33 per cent over 1870. The establishments are little subject to depression, and rarely to disturbance. Whatever may happen to other departments of business, the special forms of leather made in Philadelphia are always in demand, and there is no record of a corner in the market for Patna or Tampico goat skins.

USE OF WOOLEN CLOTHING.—Professor Jaeger, of Stuttgart, recommends the use of woolen clothing both in summer and winter, and has invented a sort of normal dress, by which he claims the accumulation of fat and water in the system can be prevented. This normal clothing consists of two essential properties; first, it consists exclusively of wool, avoiding all materials woven from plant fiber (cotton or linen); second, it makes a strong point of keeping warm the middle line of the front of the body. But the principal peculiarity of the clothing is the exclusive use of sheep's wool, even avoiding pocket and other linings of cotton.

New Publications.

Report of the Commissioner of Education for the Year 1878. Washington: Government Print. 1880.

In submitting his ninth annual report, the Commissioner refers to the financial depression of the previous years, whose disturbing influence has been felt in educational interests through the year covered by the report. He points out also the perils public education has encountered from the conflict of sentiment with reference to certain features of our systems, and sets forth, in brief, the work accomplished by the office during this first decade of its history in supplying exact and complete knowledge of the educational condition of all sections of our country.

The sources of information from which the matter of the report is derived, are reports from States, Territories and cities, from schools of all classes, and from all other institutions of an educational character, as libraries and museums. This material has increased more than eightfold since 1870. To this must be added the foreign material, reports and periodicals which are examined and the most important information they contain summarized by the translator. From the statistical summary, generalized without reference to States, it appears that the school population is, for thirty-eight States, 14,418,923; for nine Territories, 157,260; the number enrolled in public schools is, for thirty-eight States, 9,294,316; for ten Territories, 78,879; the number in daily attendance is, for thirty-one States, 5,093,298; for five Territories, 38,115; the number of pupils reported in private schools is, for twelve States, 280,492; for four Territories, 6,183; the total number of teachers is, for thirty-eight States, 269,132; for nine Territories, 2,012; the number of male teachers in thirty-four States is 100,878; in eight Territories, 789; the number of female teachers in thirty-four States, 141,780; in eight Territories, 1,027; the public school income is, for thirty-eight States, $86,035,264; for ten Territories, $942,837; the public school expenditure is, for thirty-eight States, $79,652,553; for ten Territories, $877,405; the permanent school fund for thirty-two States is $106,138,348; for one Territory, $1,506,961.

How Persons Afflicted with Bright's Disease ought to Live. By Joseph F. Edwards, M.D. Philadelphia: Presley Blakiston. 1881.

Dr. Edwards, in this book, gives some very useful information respecting the frequently obscure class of bodily ailments known popularly as "Bright's disease." He proves very clearly that this affection is much more common than is generally supposed, explains the nature of the disease and its progressive development, and gives some wholesome advice as to the mode of life to be followed by one who is affected by it.

He holds that in many instances a person with a well marked case of Bright's disease, can, by leading a proper life, live in comfort and comparatively good health for many years; that few diseases are so liable to be aggravated by neglect of hygienic rules; and that being, as a rule, a protracted disease, and one in which but little discomfort is experienced until toward the end, the advice of the physician is apt to be neglected. These, and other considerations, have induced the author to give in this book, in non-professional language, a history of this disease, and some rules, the faithful observance of which will insure to the sufferer the longest lease of life and the greatest amount of health of which he is capable.

Colorado: Its Gold and Silver Mines, Farms and Stock Ranges, and Health and Pleasure Resorts. Tourists' Guide to the Rocky Mountains. By Frank Fossett. Second Edition. New York: C. G. Crawford. 1880.

The wonderfully rapid development of this State is, with the possible exception of that of California twenty-five or thirty years ago, phenomenal in the history of the United States. For the benefit of those who are seeking reliable information concerning it, Mr. Fossett has prepared a highly interesting volume of nearly 600 pages, embracing in its contents a descriptive, historical and statistical account of the State, her resources, productions and progress.

The volume is divided into four parts. The first is substantially a tourist's and traveler's guide, and describes the routes of travel, the health and pleasure resorts, scenic attractions, climate, etc., of the State; the second part is historical; the third relates especially to the agricultural and live stock interests. The fourth, and the most extensive part, relates to Colorado's chief industry and source of wealth—the mines. The statistical and other information contained in this portion of the volume, has been prepared with great care, and from the examination we have been able to make, it appears to be very reliable and accurate. The book is fully illustrated with views of the cities, towns and scenic attractions of the State, and with several well executed maps of the more important mining districts. For any one intending to visit Colorado for business or pleasure, or who desires to inform himself concerning the State, we can safely recommend Mr. Fossett's volume.

The Popular Science Monthly. Conducted by E. L. and W. J. Youmans. New York: D. Appleton & Co., Publishers.

This standard periodical has just entered upon its eighteenth volume, which will close the ninth year of a highly prosperous existence, with every indication of an equally successful future. To those who know the *Popular Science Monthly*, no words of praise from us will be necessary. To those who do not know it, we may say that its aim is to present the best results of scientific thought, and the bearings of such results upon social, political and other affairs that nearly concern intelligent readers of all classes and professions. The Monthly is admirably conducted, and its editorial department is always fresh and interesting. These features and qualifications have gained for it a wide circulation, which it has earned by deserving. We have no more welcome visitor to our editorial table than the *Monthly*, and those of our readers who do not know it, will never regret making its acquaintance.

Harpers' Magazine; Harpers' Weekly; Harpers' Bazar. These successful periodicals continue to deserve the extensive public patronage they receive, by maintaining a high grade of literary excellence. The *Monthly*, which has just entered upon its sixty-second volume, is more popular than ever before. The high position attained by this magazine has become so universally acknowledged, that the admission of an article into its columns is *prima facia* evidence of its merit. The departments present the current social, political and historical gossip of the day in an entertaining and readable manner, while the illustrations with which the magazine abounds are notable for their artistic excellence.

The *Weekly* has become a power in the land, and through the powerful pen of its accomplished editor and the magic pencil of Nast, wields a political influence second to none of the great journals of the country; and it is particularly to the credit of the *Weekly* that its immense influence has invariably been exerted in the effort to purify American politics, to elevate the standard of political morals, and to correct actual and threatened abuses. In these laudable efforts it has achieved a remarkable success.

The *Bazar* has become indispensable to the ladies. Its fashion notes, and the designs and patterns which appear with each issue, make it invaluable to those who are ambitious to acquire the mysterious art of dressing well and becomingly; and in this respect it is no less useful to the wealthy leader of fashion than to the lady whose means are restricted.

Each of these standard publications fills its appointed sphere, and fills it well.

Golden Days. Philadelphia: Jas. Elverson, S.W. cor. 8th and Locust streets. The successful publisher of *Saturday Night* has fully justified the expectations formed upon the announcement of his intention to issue a story paper for boys that should be bright, interesting and instructive, and withal clean and wholesome in thought, word and tone. *Golden Days* is all this, and we are glad to know that it has met with remarkable favor. Moralists have frequently deplored the open and unrestricted license with which the vilest species of nasty, slangy literature is permitted to corrupt our youth; but they have done little or nothing to check its demoralizing influence. For this evil we think such papers as *Golden Days* are the best correctives, and we hail the success of this excellent story paper with special gratification.

Scribner's Monthly and *St. Nicholas.* The publishers of these popular and widely circulated periodicals announce a large number of new and attractive features for the new year, which will make these established favorites more attractive than ever. *Scribner's Monthly*, though younger in years than most of our great popular magazines, has won for itself a rank among the foremost in public estimation by sheer force of excellence. *St. Nicholas*, dear to the hearts of the little folks, is simply unapproachable.

OTHER PUBLICATIONS RECEIVED.

Summary Statement of the Imports and Exports of the United States, for the month ended August 31, 1880, and for the eight months ended the same, compared with the corresponding periods of 1879. Prepared and published by the United States Bureau of Statistics. [Corrected to October 11th, 1880].

We are indebted to the American Institute of Mining Engineers for the following papers: The Mineral Resources of Wisconsin, by R. D. Irving, Ph.D., Professor of Geology, etc., in the State University of Wisconsin, Madison. On the Self-Fluxing Properties of Chateaugay Magnetite from Clinton county, N. Y., and its Treatment in the Blast Furnace, by Dr. James P. Kimball, Bethlehem, Pa. Some Copper Deposits of Carroll county, Maryland, by Professor Persifor Frazer, Philadelphia. The Determination of Silicon and Titanium in Pig Iron and Steel, by Thomas M. Drown, M.D., and Porter W. Shimer, M.E., Lafayette College, Easton, Pa. Notes on Two Scaffoids at the Cedar Point Furnace, by T. F. Witherbee, Port Henry, N. Y. A Comparison of Certain Forms of Ports for Steel-Melting Furnaces, by P. Barnes, Springfield, Ill. The Silver Sandstone District of Utah, by Charles M. Rolker, New

York city. A Short Blast at the Warwick Furnace, Pennsylvania, by John Birkinbine, Philadelphia. Removing Scaffolds in Blast Furnaces by J. P. Witheron, Pittsburg, Pa.

Second Treatise on the Decrease of Water in Springs, Creeks and Rivers Contemporaneously with an Increase in the Hight of Floods in Cultivated Countries. By Sir Gustav Wex. With six sheets of Drawings. From the papers of the Austrian Society of Engineers and Architects. Translated by G. Weitzel, U. S. Engineer. Washington: Government Print. From the Chief of Engineers.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of THE MANUFACTURER AND BUILDER. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2739) WHY CERTAIN FLAMES ARE NON-LUMINOUS.—When gas is burned in a gas stove it has no brightness, while the same gas burned from a gas burner gives a bright light. As they both burn in the air, I do not understand the difference, and would like an explanation.—H. B. R., Wheeling, W. Va.

(2740) SILVERING BY DIPPING IN A COLD BATH.—Please give me a recipe for a silvering solution which will work in the cold. —A. E., Philadelphia, Pa.

(2741) WHY NUTS WORK LOOSE.—Why is it that nuts work loose and bolts drop out when subject to much vibration, even when they fit well and are screwed up strong with the wrench? —A. J. P., Sedalia, Mo.

(2742) SODA DIRECTLY FROM SALT.—I should like to know if any attempts have been made to produce soda directly from common salt.—S. L. W., Little Rock, Ark.

(2743) GOLD-PLATING.—Please give me a simple process by which I may plate with gold by the battery, and oblige.—M. D., Harrisburg, Pa.

(2744) KEELY'S MOTOR.—What is the nature of Mr. Keely's discovery of his new motor? I have read considerable about it in the papers, but never saw it explained. What do you think of it?—M. E. E., Cedar Keys, Fla.

(2745) THE WATER BLAST OR TROMPE.—Please inform me where I can find a description and view of an apparatus for giving an air blast by means of a fall of water.—M. McD., Vincennes, Ind.

(2746) SAWING BY ELECTRICITY.—Do you consider it practicable to "saw" wood by electricity—that is, by heating a copper wire to a red heat, or to a low heat, with an electrical battery, and burning through the wood? If so, what would an outfit cost? and how should a person protect himself from receiving shocks from the battery? This idea is a French one, but I have never heard of it being successfully used.—H. D. E., Jackson, Cal.

(2747) BURNING HYDROGEN AND OXYGEN.—Is it practicable to burn the oxygen and hydrogen obtained by the decomposition of water?—H. D. E., Jackson, Cal.

(2748) HOW HYDROGEN AND OXYGEN ARE BURNED.—How are the oxygen and hydrogen obtained as burned in an oxy-hydrogen furnace? What are the proportions of gases when used?—H. D. E., Jackson, Cal.

(2749) DRAGON'S BLOOD.—Are there any electrical qualities in dragon's blood?—H. D. E., Jackson, Cal.

(2750) ELECTRICAL BATTERY.—Do you consider Dr. J. C. Boyd's electrical battery as represented?—H. D. E., Jackson, Cal.

(2751) GREASE IN QUICKSILVER.—How can I keep the grease from quicksilver when in use for amalgamating purposes?—H. D. E., Jackson, Cal.

(2752) TO DRILL GLASS.—Please give me the best method of drilling glass.—J. E. F., Denver, Colo.

(2753) WATER-PROOFING LEATHER.—I will thank you for a recipe for making leather water-proof.—R. B. J., Salt Lake City, U. T.

(2754) HORSE-POWER OF A WATERFALL.—Please give me a rule for calculating the power of a waterfall, and oblige.—E. L. W., Fishkill-on-the-Hudson, N. Y.

(2755) AN ALLOY IMITATING SILVER.—The information I wish to obtain is, what is the best known composition for imitating silver? It must be sonorous, weight as near silver as possible, not too brittle or too soft, fit to cast in iron, copper or plaster of Paris molds, and to cast smooth, reproduce sharp edges and fine tracings. It is to be used for small ornaments and trinkets. Its cost must not be above one-third the price of silver, or less; for that matter it need not contain any silver. The color of the alloy is no object, as it can be silvered. I have heard of glass being used to cause alloys to become sonorous; if so, will not the alloy be too brittle and too light in weight? Please give me two or three alloys the composition of which will best answer the above requirements.—SILVERSMITH, New York City.

(2756) WORK ON GLUCOSE, ETC.—Do you know of any book on the manufacture of grape sugar or glucose from corn? also a book on the manufacture of sugar generally?—P. C. C., Augusta, Ga.

(2757) CORES FOR SMALL BRASS CASTINGS.—What is best for cores in small brass castings?—F. W. B., Tiffin, O.

(2758) TO SOFTEN BRASS CAST FROM SCRAP.—How can I soften brass cast from scrap?—F. W. B., Tiffin, O.

(2759) A MEDICAL QUESTION.—Will you please give me a harmless recipe, other than dyes, to prevent and restore hair that has turned prematurely gray.—A SUBSCRIBER, Newark, N. J.

(2760) KEEPING FLOWERS FRESH.—Can you give me any recipe that will answer for keeping cut flowers fresh for some time? Keeping the stems in water will not preserve them fresh for more than two or three days at the most.—L. B. W., St. Mary's, Md.

REPLIES.

(2739) WHY CERTAIN FLAMES ARE NON-LUMINOUS.—Non-luminous flames are those which both during combustion and in their combustion products are gaseous; luminous flames, on the contrary, are those which are abundantly supplied with solid particles, either artificially introduced, or supplied during the process of combustion by the decomposition of the burning gas, or by the production of solid combustion products. The luminosity of our common illuminating flames, such as burning gas, for example, is, very properly we think, ascribed to the presence of incandescent particles of carbon. Burning gas is substantially a mixture of several hydro-carbon compounds. The heat of the flame decomposes these compounds and causes a more or less complete dissociation of the hydrogen and carbon of which they consist. These dissociated elements do not burn simultaneously when the air supply is limited, as where gas is burned from an ordinary gas burner, for the reason that the separated carbon does not combine so eagerly with the oxygen of the air as hydrogen, their mutual affinities being less energetic; on this account, therefore, the more energetic hydrogen is enabled to satisfy its more active affinities by appropriating and combining with its quota of oxygen to the exclusion of the major portion of the carbon, which last is therefore deprived of the opportunity of entering into combination until it reaches the outer boundary of the flame, where it meets with an abundant supply of air. The carbon, upon the dissociation of the elements of the gas during the burning process, is separated in the form of a solid body in an extremely fine state of division, and these impalpably fine particles sailing through the intensely hot flame of the burning hydrogen, are heated to that degree that they become more or less intensely luminous. Upon reaching the outer boundaries of the flame, these highly heated particles are, according as they are present in moderate or excessive quantity, more or less completely consumed. In the last event the flame is smoky, in the former it is not. That the luminosity of the flame of common burning gas is properly ascribed to the presence in it of incandescent carbon particles, may readily be demonstrated by holding a cold surface of metal for a few moments in contact with it, whereupon the carbon particles will condense upon it in the form of soot or lampblack. If this view of the luminosity of the gas flame is correct, of which we have no doubt, it is evident that to deprive such a flame of its luminosity, it will only be necessary to supply it with such a quantity of air that there shall be oxygen enough present to completely consume not only the hydrogen, but also the carbon on the instant that dissociation of the hydro-carbons takes place. In this case, both hydrogen and carbon will find sufficient oxygen to be completely consumed in the body of the flame, to gaseous combustion products; no incandescent carbon particles will be present in it, and consequently the flame will be non-luminous. This is precisely what takes place in the gas stove, which is so contrived that the gas jet, on entering the burner, draws up with it a quantity of air sufficient to insure the complete combustion of its constituent elements. A complete verification of the correctness of this explanation is afforded by the action of the Bunsen burner, in common use in all laboratories, and of which the gas stove is simply a modification. This burner consists simply of a metallic pipe, from the base of which the gas is permitted to escape. At this point also several openings are provided in the tube, through which the gas in its ascent up the tube draws in a current of air, with which, by the time the gas reaches the mouth of the tube where it is burned, it becomes thoroughly mixed. The flame of this mixture of air and gas is non-luminous. By gradually closing the air holes at the base of the burner, and thus cutting off the air supply, the flame gradually becomes luminous, until, when the air supply is entirely cut off, the gas flame attains the normal luminosity which it has when burned from a common gas burner.

(2740) SILVERING BY DIPPING IN A COLD BATH.—For this purpose a bath is formed of a concentrated solution of bisulphite of soda, to which is added nitrate of silver until it begins to dissolve with difficulty. It is, therefore, with the double sulphite of soda and silver that cold silvering by dipping is effected. Bisulphite of potassa, ammonia, or of other alkalies, may be substituted for the bisulphite of soda, but the latter is to be preferred, because its preparation is cheaper, more easy and better known. Where the bisulphite of soda cannot be purchased ready made, the following mode of manufacture will be found satisfactory: Into a cylindrical vessel of glass introduce 10 pints of water and 10 pounds of crystallized carbonate of soda; pour a little mercury into the bottom of the vessel, so that the glass tube which conveys the sulphurous acid gas may not be choked by the crystals that form, as the opening of the tube is below the quicksilver. Arrange an apparatus for generating sulphurous acid gas—say by the action of heat on copper filings covered with concentrated sulphuric acid—and let the washed gases pass through the vessel holding the carbonate of soda. The passage of the gas through the liquid should be continued until all the carbonic acid is driven off and the liquid is so saturated with sulphurous acid that it will distinctly redden litmus paper. Then the vessel is placed aside for twenty-four hours, when the liquid above the mercury is the bisulphite of soda suitable for silvering. Before using it should be stirred with a glass rod, for the purpose of removing any carbonic acid gas that may still be contained in it; it should also be tested with blue litmus paper, and if it turns this at once a deep red, it is an evidence that the liquid contains an excess of free sulphurous acid, to remove which a slight addition of carbonate of soda should be made for the purpose of neutralizing it. The liquid is in the best condition when blue litmus paper is turned violet, or only slightly red. Care must be taken that no iron, zinc, tin or lead shall come in contact with it. Having prepared the solution of bisulphite of soda after the above formula, a moderately concentrated solution of nitrate of silver in distilled water is gradually added, while the bath is continually stirred with a glass rod. At first a white flocculent precipitate of sulphite of silver separates, which is dissolved by the bisulphite of soda on stirring. The addition of nitrate of silver should be continued so long as the precipitated silver salt is readily dissolved, and should be stopped when it disappears with difficulty. This bath is always ready to work, and produces an instantaneous and magnificent silvering upon copper, bronze or brass articles, which have been previously thoroughly cleansed. According to the length of time of the immersion, the deposit of silver will be more or less heavy. The loss of silver is made good by additions of nitrate of silver from time to time. When the proportion of bisulphite is not sufficient to dissolve the silver salt, it is necessary to add some fresh bisulphite of soda to restore the bath.

(2741) WHY NUTS WORK LOOSE.—This is a complaint of long standing. The best explanation of the fact that we have seen is that offered by Mr. Joshua Rose, a well-known mechanical writer, in answer to a similarly worded inquiry. We can add nothing to its completeness, and therefore give it *verbatim* for the benefit of A. J. P. Mr. Rose explains that the tendency of a nut to unwind and recede from the pressure upon its radial face, is proportionate to the pitch of the thread and the diameter of the bolt; and the finer the thread upon a given diameter of bolt, or the larger the diameter of bolt with a given pitch of thread, the less will be the tendency of the nut to move back. In the case of ordinary bolts and nuts, a given diameter of bolt is given a standard pitch of thread, and these pitches are not so fine as to prevent the nuts from unscrewing in many cases, unless check-nuts are used. It would appear that if the nut-thread fits reasonably tight upon the bolt, and the nut is screwed well home, it should retain there; but there are palpable reasons why it does not do so. Of these, the chief are the errors which ensue from the alteration of form which takes place in the screw-cutting tools during the hardening process. As a rule, all steel increases in dimensions from being hardened. What the amount of increase or expansion is we have at present no very definite knowledge, because it varies considerably, although it is probably the same when the conditions are identical. Suppose then that a tap is made of the correct diameter to a Vernier gauge, and that it increases in diameter and in length (as it almost invariably does) during the hardening, then the pitch, the thickness, the depth and the diameter of the thread will be altered, and "out of true." Unless both the tap and the die are tempered to precisely the same shade of color, the amount of error will vary. As a result of these at present irremediable errors, taps are made to suit existing solid dies, or adjustable dies are set to suit the taps; and though the nut may fit closely to the bolt, so as to be just movable by hand, or under the moderate pressure of a wrench, yet the sides of the thread do not fit properly, nor can they be made to do so under any ordinary conditions. The result is that, under vibration, the threads give way on the contact sides, for vibration is, in effect, a number of minute blows. Under reciprocating motion the result is precisely similar, for the whole pressure upon the nut is supported by that part of the surface of the thread which is in contact, which compresses or recedes. Any machinist who desires to test this matter, may do so by taking a nut that fits very tightly upon a bolt, and, striking upon the sides, he will find it will lose the fit to the bolt.

(2742) SODA DIRECTLY FROM SALT.—Many attempts to effect the economical production of soda, on a commercial scale, directly from common salt have been made, but until within the past ten years only one of them has proved commercially successful. This one exception is the so-called ammonia-soda process, which is now successfully carried on in a number of establishments in France, Belgium and Germany, and perhaps in other countries. This process, which was first patented in England by Messrs. Dyar and Hemming, in the year 1838, is a direct one. It is based on the fact that when solutions of common salt and bicarbonate of ammonia are brought together, a double decomposition takes place, resulting in the production of bicarbonate of soda and sal-ammoniac. The bicarbonate of soda is decomposed with the aid of heat, by which one equivalent of carbonic acid is driven off and the simple carbonate is produced. The carbonic acid is utilized to produce bicarbonate of ammonia for a fresh operation, the sal-ammoniac being

treated with caustic lime to liberate the ammonia for that purpose. Chloride of calcium is left as a by-product. Many attempts were made by the original inventors and others since their time, to work this process profitably, but until M. Solvay, a Belgian manufacturer, took hold of the problem about ten years ago, none had succeeded. Solvay, however, by careful study of the details of the process, devised several very ingenious improvements in the method and achieved quite a notable success; so that at the present time many thousand tons of ammonia-soda are annually produced by his methods. Our correspondent will find this process described in our February number for 1880, and will find more or less extended references to it in the reports of the Vienna, Paris and Philadelphia exhibitions. The experiment of decomposing common salt by bringing it in contact with superheated steam has been attempted in various ways, but with no encouraging results. A decomposition takes place, but it is only partial. Thus far the ammonia process above referred to is the only direct one worthy of mention.

(2743) GOLD-PLATING.—The following is about as simple a process for gold-plating as we know of: The first essential will be to prepare the gold-plating solution. This may be done by taking one or more gold coins, dissolving the same in nitro-muriatic acid, and evaporating the solution to dryness on the water bath. The residue should then be re-dissolved in water, acidulated with a little muriatic acid, and filtered. To the solution thus obtained add an excess of sulphate of iron, which will precipitate all the gold in the form of a brown powder, while the copper with which the coin was alloyed is left in solution. The pure precipitated gold should then be well washed, dissolved again in nitro-muriatic acid, evaporated to dryness as before, and re-dissolved in distilled water. The solution thus obtained contains pure chloride of gold. To this solution add a solution of cyanide of potassium, continuing the addition until the precipitate of cyanide of gold that has formed is completely re-dissolved. Or perhaps a preferable method would be to add to the chloride of gold a solution of cyanide of potassium very cautiously so long as any precipitate forms, being careful not to add an excess. The precipitate yellow powder is the cyanide of gold, which, being insoluble in water, can readily be filtered and washed. From this powder prepare the gilding solution by the following formula:

Cyanide of potassium	2 ounces.
Cyanide of gold	¼ ounce.
Distilled water	20 ounces.

The cyanide of gold is soluble in the alkaline cyanide, and forms a double salt. The solution is used with a Smee or Daniel battery, a sheet of pure gold being immersed in the liquid as the positive electrode, to replenish the bath as the gold is withdrawn from it by deposition on the articles gilded, which are suspended in the bath at the negative pole.

(2744) KEELY'S MOTOR.—So far as we have been able to learn, Mr. Keely claims to have discovered a method of evolving from water (or a mixture of water and air), by purely mechanical means, a cold vapor enormously more rapid in the process of its production, and enormously more energetic, than steam. It is asserted that this enormous force is generated at comparatively little expense, and without the employment of fuel, fire, electricity or chemical agency. We have been informed that Mr. Keely declares that he does not understand the nature of the force he claims to have discovered, and that his greatest difficulty in perfecting his motor, for practical purposes, has been owing to his ignorance of the laws in obedience to which it manifests itself. By consulting the back volumes of the MANUFACTURER AND BUILDER, our correspondent will find the answer to his last question, a number of articles criticizing the claims of Mr. Keely having appeared in our columns. It is hardly necessary for us to add that the opinions there expressed are decidedly unfavorable to Mr. Keely's claims. So much has been written in this journal on the subject that we do not feel like adding to it, unless some new announcement on the part of Mr. Keely or his friends should again bring the subject prominently before the public.

(2745) THE WATER BLAST OR TROMPE.—We send this correspondent by letter a few sketches showing several forms of the apparatus he inquires about, which is known as the trompe or water blast, and which is said to be in use even at the present time in parts of Italy and the Pyrenees for furnishing the blast in iron making. It consists of an upright tube of wood or metal, of a length and dimensions suited to the fall and volume of water to be used. This tube is connected below with a box or cistern made air-tight, with the exception of an opening at or near the top, from which the blast may be delivered, while the excess of water is permitted to escape from openings provided at the bottom. The tube is provided with a number of lateral openings, and the stream of water, which is admitted at the top from a suitable source of supply, in falling down the tube, draws in through these openings a quantity of air, which is carried down with it into the cistern. This air has no means of escape except through the opening provided at the top of the cistern, from which it is delivered by suitable connecting pipes to the place where it is required. By this means a steady blast of air will be obtained. The quantity of air that can be delivered in this manner, and its pressure, will depend on the quantity of water, the hight of fall, the proportion of parts of the apparatus, and other contingencies. This apparatus may be found very convenient for many uses where an air blast of moderate pressure is required, as it is cheap to construct, not liable to derangement, and entirely automatic; but it uses more water than a water-wheel would do for a given effect.

(2746) SAWING BY ELECTRICITY.—We have often met with the statement that some inventive genius had patented the plan of sawing wood and felling timber by means of a platinum wire kept at a white heat by means of a galvanic battery. This is what our inquirer doubtless refers to. We consider the notion visionary and impracticable, for the cost of operating such a plan with a battery would be out of all proportion to its work when compared with that performed by a saw. Even were the dynamo-electric machine used in place of the battery, which would be a far more economical source of electricity than the latter, the idea would still be hopelessly absurd, for such a machine will require a steam engine to run it, and therefore why not let the engine run the saw directly instead of introducing an expensive electrical machine that will waste 30 or 40 per cent of the engine power to heat the wire to do the work that the saw does quickly without it? The notion is so impracticable that we do not believe it has ever been seriously entertained. In surgical operations the hot wire has, we believe, been successfully used, but there the conditions are quite different.

(2747) BURNING HYDROGEN AND OXYGEN.—We do not quite comprehend the object of this inquirer's second question. It is entirely "practicable" to burn the oxygen and hydrogen obtained by the decomposition of water. It would only be necessary for the purpose to gauge the capacity and power of the battery used for the decomposition of the water, so that a constant current of the two gases should be supplied to the blow-pipe or jet from which they were burned, and so make the operation continuous. But such a plan would not be economical, for the reason that we can manufacture hydrogen and oxygen much more cheaply by chemical methods than by the decomposition of water with the galvanic battery. This will appear in our answer to the next question.

(2748) HOW HYDROGEN AND OXYGEN ARE BURNED.—Oxygen is usually prepared by heating the substance known as chlorate of potassa, which yields about 39 per cent of its weight of the gas when heated. Half an ounce will yield 270 cubic inches, or nearly a gallon of oxygen. A pound will yield about 30 gallons. It is customory to mix with the chlorate of potassa a little black oxide of manganese, which seems to facilitate the disengagement of the oxygen at a much lower temperature than otherwise, while it also insures against the violent disengagement of the gas, which is apt to occur when the chlorate is used alone. For this purpose a strong copper retort is generally used, provided with a pipe of the same metal, held over the mouth of the retort by a gallows-screw connection. This pipe is connected by means of an India rubber tube with a wash-bottle containing water to wash the gas, and this in turn with a second tube which conveys the gas to the gas-holder. The gas is collected over water, in a gas-holder of ordinary construction, that can be weighted so as to deliver the gas at any required pressure. Hydrogen may be generated by one or the other of the plans named below. By passing steam over iron filings placed in an iron tube, kept at a red heat in a furnace; or by treating zinc or iron-scrap with diluted sulphuric acid. The latter plan is the one generally followed. The acid and water should be mixed first (by pouring the *acid* into the water), and allowed to cool before introducing the iron (or zinc). The best proportions are, sulphuric acid, 1 pound; water, 3 pounds; iron turnings, 1 pound, which will produce about 4 cubic feet of hydrogen. Balloonists who occasionally use hydrogen to inflate their balloons, generate it in a set of stout liquor casks, conducting it as it is generated through cold water, to wash it. The formula given by Mr. Wise, per cask, is, water, 560 pounds; oil of vitriol, 144 pounds; iron turnings, 125 pounds. This mixture should yield 600 cubic feet of hydrogen. It can also be kept above water. The only apparatus in which hydrogen and oxygen can be burned safely and practically is in the so-called oxy-hydrogen blow-pipe, which consists of two concentric nozzles, by which a jet of oxygen is introduced into the center of a jet of burning hydrogen, both gases issuing from the mouth of the blow-pipe under considerable pressure. The heat of this flame is the most intense that it has been possible thus far to attain. Where common burning gas is readily attainable, it affords a good practical substitute for the hydrogen, and is generally used in place of it in the lecture room. These gases are often pumped into strong iron cylinders under a pressure of several hundred pounds to the square inch, from which therefore a considerable supply can be obtained—enough for an evening's work with the lime light, etc. The proper proportions of the gases for perfect combustion and for giving the best results, are two volumes of hydrogen to one of oxygen.

(2749) DRAGON'S BLOOD.—Dragon's blood is said to be a resin obtained from the fruit of several species of the Rattan palm, and like all other resinous substances, is doubtless capable of becoming electrified by friction, like amber or shellac. In this state it will attract and repel light objects, such as bits of paper, pith balls, etc. By melting some of the powder and running it into the form of a stick or rod, our inquirer may readily satisfy himself on this point by rubbing it with a piece of dry flannel, and thereupon approaching it to certain light objects, as above named.

(2750) ELECTRICAL BATTERY.—At the present writing we have no knowledge of the electrical battery of Dr. Boyd. If our correspondent will send us a printed description of the apparatus, we will pass an opinion on it.

(2751) GREASE IN QUICKSILVER.—We are hardly prepared to answer this question intelligently, from the fact that we do not clearly understand how grease should get into the quicksilver. We can only infer that it is introduced from the machinery of the stamp mill or the amalgamator. If this is the case, it indicates carelessness on the part of those in charge of the machinery, or crude and badly working machinery. In either case, it seems to us, the remedy is in the hands of the attendants, who should see that no grease can find its way into the amalgamator or on the plates. We should not like to say more on this topic from the imperfect knowledge that we have of the cause of this trouble.

(2752) TO DRILL GLASS.—The best method of drilling holes in glass, is to use a splinter of diamond. A brass drill is made to fit the drill-stock, sawn down slightly with a notched knife, to allow the splinter to fit tightly, and the splinter is fixed in the split wire with hot shellac or sealing-wax. This drill is to be used dry, and carefully. If the hole to be drilled is wanted larger than the tool, drill a number of small holes close together, to form a circle as large as the hole required; then join them with a sharp file. A splinter of diamond large enough for a ¼-inch hole can be bought for about fifty cents. Glass can be drilled with a common steel drill kept moistened with spirits of turpentine, but the above method is more reliable.

(2753) WATER-PROOFING LEATHER.—We give this inquirer several formulas for water-proofing leather: 1. India rubber in shavings, 1 ounce; boiled linseed oil, 1 pint; dissolve by heat, then add 1 pint of hot boiled oil; stir well and cool. 2. Take of beeswax and yellow rosin 2 ounces each; melt in 1 pint of boiled linseed oil. 3. White wax and spermaceti, 1 ounce each, and 4 ounces of mutton suet; melt in 1 pint of olive oil. These solutions should be applied to the article warm, and may be used for water-proofing leather-work of all descriptions.

(2754) HORSE-POWER OF A WATERFALL.—A horse-power represents 33,000 pounds raised one foot high per minute, or 33,000 foot-pounds, consequently 33,000 pounds of water flowing in a stream per minute, would exert one horse-power for every foot of fall. To calculate the power of a waterfall, therefore, proceed as follows: Compute the number of cubic feet of water flowing per minute, by multiplying the area of its cross section in feet by the velocity of flow in feet per minute. To ascertain the weight of this volume of water, multiply it by 62½, which is the weight of one cubic foot of water. Then multiply this product by the vertical fall in feet. This will give the number of foot-pounds per minute; and by dividing this by 33,000, the result will be the horse-power of the fall. *Example.*—Given a stream 12 feet wide and 3 feet deep; the area of its cross section is $(12\times3)=36$ feet. Let the velocity of its flow be 100 feet per minute, then $(36\times100)=3{,}600$ feet of water flow over the fall per minute, the weight of which is $(3{,}600\times62\frac{1}{2})=225{,}000$ pounds. Let the fall be 12 feet; then the power of the fall in foot-pounds will be $(225{,}000\times12)=2{,}700{,}000$ foot-pounds; and its horse-power would be $(2{,}700{,}000\div33{,}000)=81.8$ H. P.

(2755) AN ALLOY IMITATING SILVER.—"Silversmith" should visit a public library and consult some of the published works on metallic alloys, in which he may perhaps find some information on the subject of his inquiry, which his knowledge of the trade will enable him to apply to his wants. He may find useful hints in "Gautier's Metallic Alloys," or "Spon's Workshop Receipts." It should be apparent to "Silversmith" that it would be highly indiscreet, to say the least, to publish a reply to such a question as he asks, in the columns of a widely circulated technical journal like the MANUFACTURER AND BUILDER, since such information, coming into possession of evilly disposed persons, might be put to improper uses.

(2756) WORK ON GLUCOSE, ETC.—In answer to this inquirer, we will state that a work, entitled "A Practical Treatise on the Manufacture of Starch, Dextrine and Glucose," has just been published, and is the only American treatise on these manufactures. It is illustrated by some 75 engravings, covering the whole subject in all its details. It is complete in one volume of about 300 octavo pages. We can furnish this work for $3.50 postpaid.

(2757) CORES FOR SMALL BRASS CASTINGS.—Use what is called in the trade ordinary core-sand, mixed with about one-third of burnt sand (that is, sand that has been used in molding castings), with the addition of a very small proportion of flour—just enough to make it hold together. Sometimes a small quantity of salt is added to harden the core, to give it strength and stiffness. If the core must be very strong, use a small quantity of powdered rosin without salt.

(2758) TO SOFTEN BRASS CAST FROM SCRAP.—The trouble with brass cast from scrap, is usually to be ascribed to the presence of iron or steel scrap that gets mixed with it in the shop. In that case only a chrome steel tool will answer to work it. The best plan probably would be to melt the scrap at as low a heat as possible, with the addition of some powdered glass as flux, by which procedure the iron will be fluxed out, and the brass left comparatively free.

(2759) A MEDICAL QUESTION.—In accordance with the rule we have laid down in our conduct of this department, we must decline to answer all questions asking for medical advice. The editor of the MANUFACTURER AND BUILDER is not a physician. This inquirer will, therefore, perceive that it would be highly improper for him to offer any advice in his case.

(2760) KEEPING FLOWERS FRESH.—Try the addition of common sal-ammoniac to the water in which you keep the flowers, using the salt in about the proportion of 75 grains to the quart of water. By this simple method, cut flowers, it is said, may be kept fresh for several weeks, or even a month.

THE MANUFACTURER AND BUILDER.

Vol. XIII.—No. 2. FEBRUARY, 1881. THIRTEENTH YEAR.

The Tyson Vase Engine.

The necessity of small domestic motors for a variety of uses has long been felt, and has called for the exercise of much ingenuity on the part of a number of inventors, who have essayed the task of devising machines that should meet the requirements of practice. The machines that have been invented for these purposes, comprise gas, caloric, hydraulic, electrical and other forms of engines in great variety, with many forms of which our readers will be familiar from the descriptions that have appeared in this journal.

Small steam engines of various patterns have

Fig. 1.—Tyson Vase Engine on Tripod.

been tried, but generally required skilled attendance, smelled unpleasantly of gas, oil or decomposed lubricants, or were not readily controllable; took too long to get up steam and cool down; were heavy, bulky and expensive; or were unsafe on account of liability to explode. For one or several of these reasons, small steam engines for domestic service have not been practically successful. It has remained for Mr. Charles Tyson, of Philadelphia, to devise a domestic steam engine which practically disposes of these objections.

We present herewith a series of illustrations of a steam engine of novel construction, manufactured by the Tyson Engine Company, of 1301 Buttonwood street, Philadelphia, and which meets the practical requirements of a domestic motor more nearly than anything of the kind that we have yet seen. Fig. 5 represents an ideal section, from which the arrangement of parts and the operation of the system may be understood. The system involves

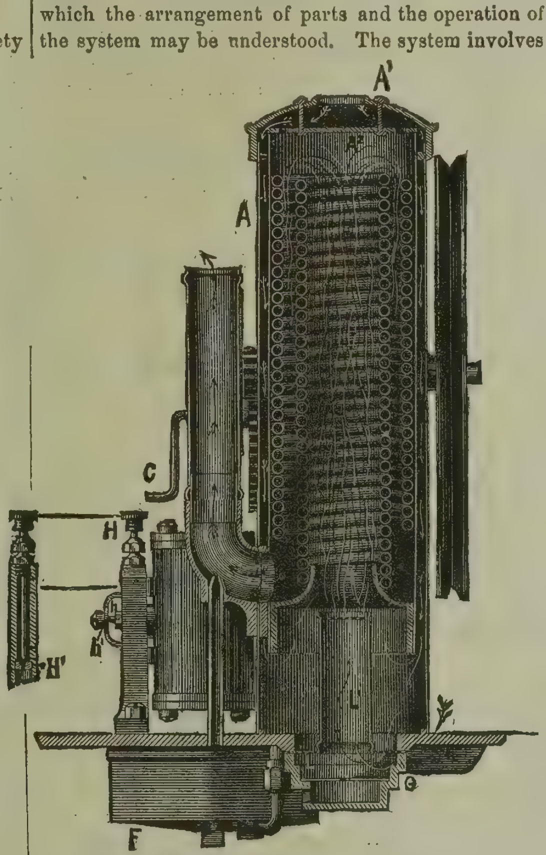


Fig. 2.—Sectional View Through Generator.

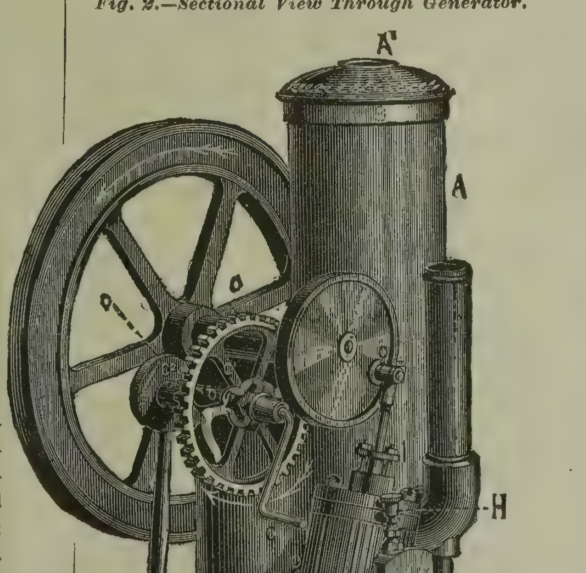


Fig. 3.—Perspective View of Engine and Rim of Vase.

the use primarily of a copper coil generator, in which minute quantities of water are successively and instantaneously flashed into steam. This construction, therefore, requires no water space in the generator, and but little volume for steam, and has the merits of giving great absolute strength, quick steaming capacity, and, what is highly important, no liability to explode.

The Tyson system dispenses with the necessity for steam and water gauges and safety valves. The pump, seen in Fig. 5, is worked by hand to produce pressure in the air-chamber; the chamber is connected to the

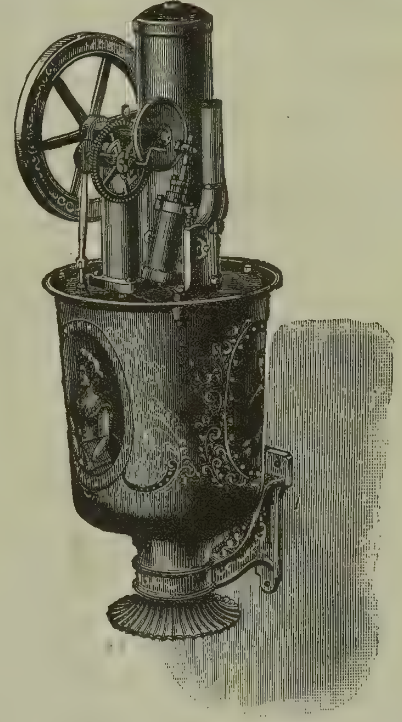


Fig. 4.—Tyson Vase Engine on Wall Bracket.

steam chest of the engine by means of a long pipe, part of which is coiled in a receptacle through which exhaust steam from the engine has access, and part in a furnace. The water is converted into steam in its transit through this pipe, which is delivered to the chest of the engine at the pressure produced by the

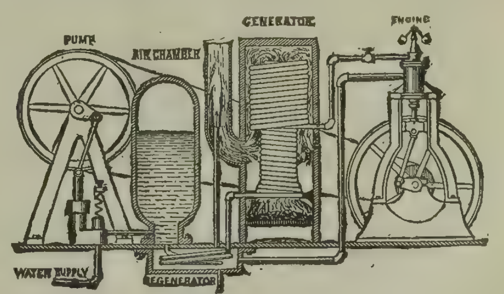


Fig. 5.—Tyson Motor System.

pump. When the engine is started it imparts motion to the pump, and the pre-induced pressure is maintained. Should the engine be stopped and the fire continue to burn, the water in the coil is forced back to the air-chamber, and the production of steam is thereby checked; the engine being again started, the pressure in the air-chamber again forces water through the heated coil, and the generation of steam is resumed. A relief valve at the right of the pump limits the pressure; this is in no sense a safety-valve, for even if it

were fixed so as not to yield to pressure, no explosion could occur—the mechanism of the pump not being strong enough to produce a bursting pressure. Gas is used as fuel, but the machine can be made to burn either coal, wood or oil.

Fig. 2 shows more fully the construction of the generator. It consists of a cylindrical shell, in which is coiled about 35 feet of seamless copper tubing. The heat is supplied by a gas-burner L at the base. Surrounding this shell is a second one, leaving an annular space for the entrance of air. The air feeding the gas flame enters from below, and the gases of combustion pass up through the center of the coils and down between the two shells, and then out by the draft pipe. On first lighting the gas, the cap A′ is removed and the flame allowed to burn up into the air; but as soon as steam begins to form the cap is replaced, and the exhaust steam then creates sufficient draft to carry the burning gases through the coils and out of the escape pipe. This generator has about one-50th of the cubical capacity of that required by a boiler of the ordinary type to run the same engine.

The engine is of the simple oscillating type, and the whole apparatus is attached to a bed plate, forming the top of a vase-shaped receptacle. The vase is used to contain the water from which the pump supplies the reservoir. For or five quarts of water for as many hours' work will be found to answer.

Fig. 1 represents a small motor of this type now being manufactured by the aforesaid company, and introduced for driving sewing machines, dental lathes, scroll saws, and a variety of other uses. It is estimated at about one-33d of a horse-power, equivalent to a duty of 1,000 foot-pounds per minute. Quite a number of these machines are already in use for the above named and other purposes. It is very ornamental in design, and can be used in the shop, office or parlor, at pleasure. In a modified form, the vase is supported from a bracket attached to the wall. This design is shown in Fig. 4. A perspective view of engine and rim of vase is shown in Fig. 3.

These motors are made in the best manner by means of machinery and tools specially designed for the purpose. The very best material is used for all the parts. The pump shaft, main shaft, crank pin and piston rod are of fine cast steel. The cylinder, rod, piston and valve arrangements of the pump are of brass. The steam and water pipes, generator and heater coils (comprising 35 feet), are made of seamless copper tubing. The cylinder is accurately bored, and the piston is packed with asbestos and graphite. The cylinder is covered with a walnut lagging, secured with nickel-plated brass shells. The throttle valve is of brass and nickel-plated. The main bearings are mounted with oil cups of brass, nickel-plated.

In the machines now being built a specially devised governor is provided and attached to the shaft direct, so that the engine will not race should the belt come off. An extra driving wheel upon the main shaft is so arranged that the engine can readily be attached to drive most makes of sewing machines.

The pump is of improved construction and positive in its action. The exhaust steam is utilized to heat the feed, and finally escapes into the draft pipe, making an effective exhaust blast. The engine proper is of such simple construction as not to be liable to get out of order. The drippings from the engine (oil or water) are received by the vase, and the floor or carpet thus protected. The entire machine may be removed from the vase which contains the water supply. The blast pipe is made of brass, and nickel-plated. The tripod, vase and unfinished parts of the engine are handsomely japanned and ornamented.

The machine seems excellently adapted for a great variety of domestic uses where a small amount of power is required from time to time. The first cost of the machine is moderate enough to place it within the reach of every one, and the expense of running it (say with gas at $2 per 1,000 cub. ft.) will hardly exceed two cents per hour. For further details we refer our readers to the manufacturers.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 2. THIRTEENTH YEAR.

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(Illustrated articles are indicated by an asterisk (*).

Agencies where the Manufacturer and Builder can be Found on Sale.

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Telegraphic Monopoly.

The events of the past month have made it apparent that the time has at length arrived when, in the interest of the people, our government should either assume the exclusive control of the telegraphic business of the country by the purchase of the existing lines at a fair valuation upon their cost, or should without unnecessary delay establish a postal telegraphic system after the plan in general use abroad. The farce of establishing an opposition line to the gigantic corporation which controls the telegraphic business has been played again and again, and always with the same leading features and the same *denoument*.

The history of the last performance of this farce is specially worth studying. A shrewd financier, controlling a large amount of capital, announces his intention to establish a telegraphic service. There is much dissatisfaction with the company that has up to this time had a monopoly of telegraphic business. It has been managed in the interest of stock jobbers; its stock has been doubled again and again, then trebled and quadrupled, by the well-known process of "watering." It is obliged, in order to pay dividends upon this immense block of watered stock, to keep its rates at such exorbitant figures, that the telegraph, instead of being an institution of vast public utility and convenience, has remained a useful but very expensive luxury, only called into requisition in cases of real necessity. The aforesaid financier, appreciating the urgent public demand for cheap telegraphy, organizes his company and proceeds to spread his lines between the leading centers of business. It is announced with a flourish of trumpets that the new company will serve the public at reasonable rates. The suspicion that finds expression in certain quarters, that the whole object of the movement may be simply to start a threatening opposition to the monopoly, in order to compel the latter to buy it up at a good figure, and permit the aforesaid financier to pocket a number of millions by the operation, is scouted with virtuous indignation. There is to be no such thing as buying up or consolidating this line. The public see vast preparations made for starting business, the newspapers report daily conflicts between the rivals, in which the monopoly strive to prevent the erection of the opposition lines. At length the new company opens its doors to the public. Its rates are low, and it rapidly acquires a large patronage. The public rejoice. The diversion of traffic to the new line sensibly affects the receipts of the monopoly. The "bears" are let loose upon the Stock Exchange, and the stock of the great corporation weakens day by day. It had done, and left undone, so much to deserve public opprobrium in the past, that now in its day of adversity it has no friends. Wall Street shares the public opinion. It becomes the daily amusement of the *habitués* of that famous quarter to "go short" of Western Union and hammer down the stock a point or two for delivery. But suddenly the aspect of things changes; it is mysteriously hinted by a favored few who enjoy the confidence of certain magnates, that negotiations are in progress looking to a consolidation of the new line with the monopoly. The street hastens to cover its "shorts" as best it may, while the public, loath to believe the story of such deliberate treachery, at first incredulous, are forced at length to believe, by the brazen announcement that the shameless bargain has been consummated. The familiar watering process is gone through with, the public-spirited orignator of the opposition scheme bags his plunder, and the farce is played. In this picture our readers will recognize the history of the late American Union Telegraph Company, from the time of its origin down to its consolidation with the Western Union Company a few weeks ago.

The practical result of this brilliant piece of "financiering" (we think that is the correct word), is that the stock of a corporation, which, previous to the consolidation, had been expanded to $40,000,000, representing what actually cost about $10,000,000, has been still further expanded to the prodigious figure of $80,000,-

000, by the acquisition of a property which cost two or three. To earn dividends upon this enormously inflated stock, the telegraphic rates must necessarily be raised, and the American public, which has all along paid the highest price for the poorest telegraphic service in the world, will soon have the option of paying still more or doing without it.

It is high time that this sort of thing should end. The telegraph is one of the most important elements in modern civilization, and has become too essential a factor in the social, commercial and political world to be left in the control of individuals or corporations, to be offered to the people on such terms as they may choose to dictate.

The people wisely recognize the necessity of giving the coinage of money and the postal service into the hands of the government. The telegraph is no less important as an institution of public utility and convenience than either of these, and it should be placed side by side with them under government control, that the people may realize the greatest benefits from its use. The leading nations of Europe have already taken this step, and in so important a matter we should not hesitate to follow their example. The monopoly of the telegraph is contrary to enlightened public policy, and should not be tolerated. The telegraphic service should be assumed by the government in the interests of the people. Down with the monopoly!

The Wires Down Again!

A few weeks ago, as all our readers will remember, a violent storm of rain and sleet visited the Eastern section of the country, and besides interfering very materially with business of all kinds, sadly demoralized the telegraphic service by the breaking of wires and blowing over of poles, so that for several days the business centers of the country were practically isolated from the outer world. How complete this isolation was in this city, will best be understood by the following brief quotation from one of the newspapers of the day following the storm:

"Telegraph poles and wires were broken, and the city was, during most of the day, isolated from the remainder of the world as far as telegraphic communication was concerned. The last instance of the kind occurred on January 5, 1873, but the isolation then was not as complete as that of yesterday. The private lines and public routes of telephone systems were all prostrated or otherwise interfered with; the telegraphs connecting the various Exchanges were rendered useless, and the police and fire lines could not be operated. A direct loss of more than $300,000 is believed to have resulted to the telegraph and telephone companies, to say nothing of the indirect loss owing to their inability to do the work they would otherwise have done. The lack of the customary telegraphic facilities at the Produce and Cotton Exchanges made it impossible to transact business at those places after about 10 A.M., and the number of transactions at the Stock Exchange was made surprisingly low for similar reasons. In sending news from the different police precincts, messengers had to be employed, and in guarding against fire resort was had to the method formerly in vogue of having mounted firemen patrol the streets and ride post-haste to the engine houses with notices of fires. . . . Accidents caused by falling telegraph poles, by the broken ends of wires swinging loosely from their usual fastenings, and by icicles, were somewhat numerous, but they were generally not of a serious nature."

In view of the fact that serious interruptions of telegraphic communication are by no means rare, but, on the contrary, occur quite frequently, it is a matter of very serious import to know whether the methods of telegraphing are still so crude and inadequate as to be at the mercy of wind and weather. That this question is one in which every citizen has a personal interest is self-evident; but inasmuch as it will require no serious strain on the understanding to imagine circumstances in which it might be a matter of supreme importance to the whole country to be able to depend upon telegraphic intercourse with certainty, the question acquires more than personal interest.

As Americans claim the honor of having created the telegraph, and as many of the most important telegraphic devices have been invented by Americans, it would seem at first thought to be unnecessary to inquire if we are behind other nations in the adoption and use of important improvements in the construction of lines and in telegraphic service. It is nevertheless true, that other countries have left us far behind in these important matters, not only in respect to the construction and maintenance of lines which are independent of everything save an earthquake, but likewise in making the telegraph in point of cheapness of service, and almost universal distribution, a public convenience to an extent which is not dreamed of in this country. These statements are not merely vague generalities, but sober facts which can be amply proven, and which have long been well known to those who have given any attention to the study of the telegraphic service of this and other countries.

We are interested here, however, simply in the question of determining if it is possible to so construct lines of telegraph as to make them independent of wind and weather. We answer, Yes! by the abandonment of the posts and overhead wires, and the adoption of the underground system. In one form or another the underground telegraph has been in use in Europe for the last quarter of a century. In all the important cities and towns of the continent the underground cable has taken the place of the overhead wire, and the unsightly posts that disfigure the finest avenues of American cities are nowhere to be seen.

But the underground system is not confined to cities and towns. It is used for extended land lines, and today there are thousands of miles of such lines in successful operation. These statements can readily be verified. So long ago as 1873, David Brooks, a well-known electrician, in his report as United States Commissioner to the Vienna Exhibition, wrote on the subject as follows: "The wires are run underground in the cities of Berlin, Dresden, Breslau, Danzig, Stettin, Hamburg, Bremen, Cologne, Frankfort-on-the-Main, Mayence, Carlsruhe, and other large cities and towns in Germany, and in Geneva, Lausanne, Berne, Neufchâtel, Zürich, Winterthur, Schaffhausen, St. Galle and Lugano in Switzerland. In nearly all the cities of Europe neither poles nor wires are visible, but the system of underground cables is used instead. . . . There are now in Paris working lines that have been buried for 25 years, and which have entailed little or no expense, except their first cost. It is especially worthy of note in this particular, that during the reign of the Commune, when almost every institution of public utility was destroyed, not a single underground wire was disturbed."

Evidence like the above, demonstrating the successful operation of the underground system in cities and towns, might be multiplied indefinitely. But since the time of Mr. Brooks' report, the underground system has received an immense and important extension. At that time, it is true, innumerable cables were laid across rivers, and the Alps and other mountain ranges were crossed by cables lying in the ground, but no general substitution of cables for overhead lines throughout the country had been attempted. Since then the German government has led the way in this important improvement. In the year 1876, an experimental underground line was laid down between the cities of Berlin and Halle, a distance of 105 miles, and this was found to operate so successfully that the decision was taken to connect all the important cities and towns of the empire by similar underground wires. This decision has since been carried into effect, and at the present time a perfect net-work of underground cables, completely secure against the vagaries of the weather, have been laid between the leading German cities, and have fully demonstrated their superiority over the plan that they have displaced.

In the face of these facts, it is either ignorance or perversity on the part of those interested in the maintenance of the present system to speak of the cable system as "an experiment which has met with but questionable success"—an expression which is often used. There are substantial reasons, doubtless, that may be urged against the practicability of the universal substitution of overhead lines, the chief of which is the vast extent of territory over which telegraphic communication must be maintained, and the enormous expense which would be entailed in laying underground lines. But there can be no valid reason, no excuse, for maintaining the chronic nuisance of poles and wires in the streets of our cities; and none why the chief commercial centers—New York, Philadelphia, Boston, Chicago, Baltimore and other cities—should not be connected by lines of underground telegraph, that would not be liable to injury or interruption of communication from such causes as those of a few weeks ago.

The past history of the gigantic corporation which controls the telegraphic business of the country, is not of a character to inspire much hope that its officials will voluntarily take the initiative in introducing an improvement which involves the outlay of considerable money. The authorities of our cities, however, have it in their power to banish the poles and wires from their streets, and to compel the adoption of the system universally and successfully used elsewhere. They should exercise that authority promptly and decisively, and thus pave the way for the gradual extension of the underground system.

Weather Prophets.

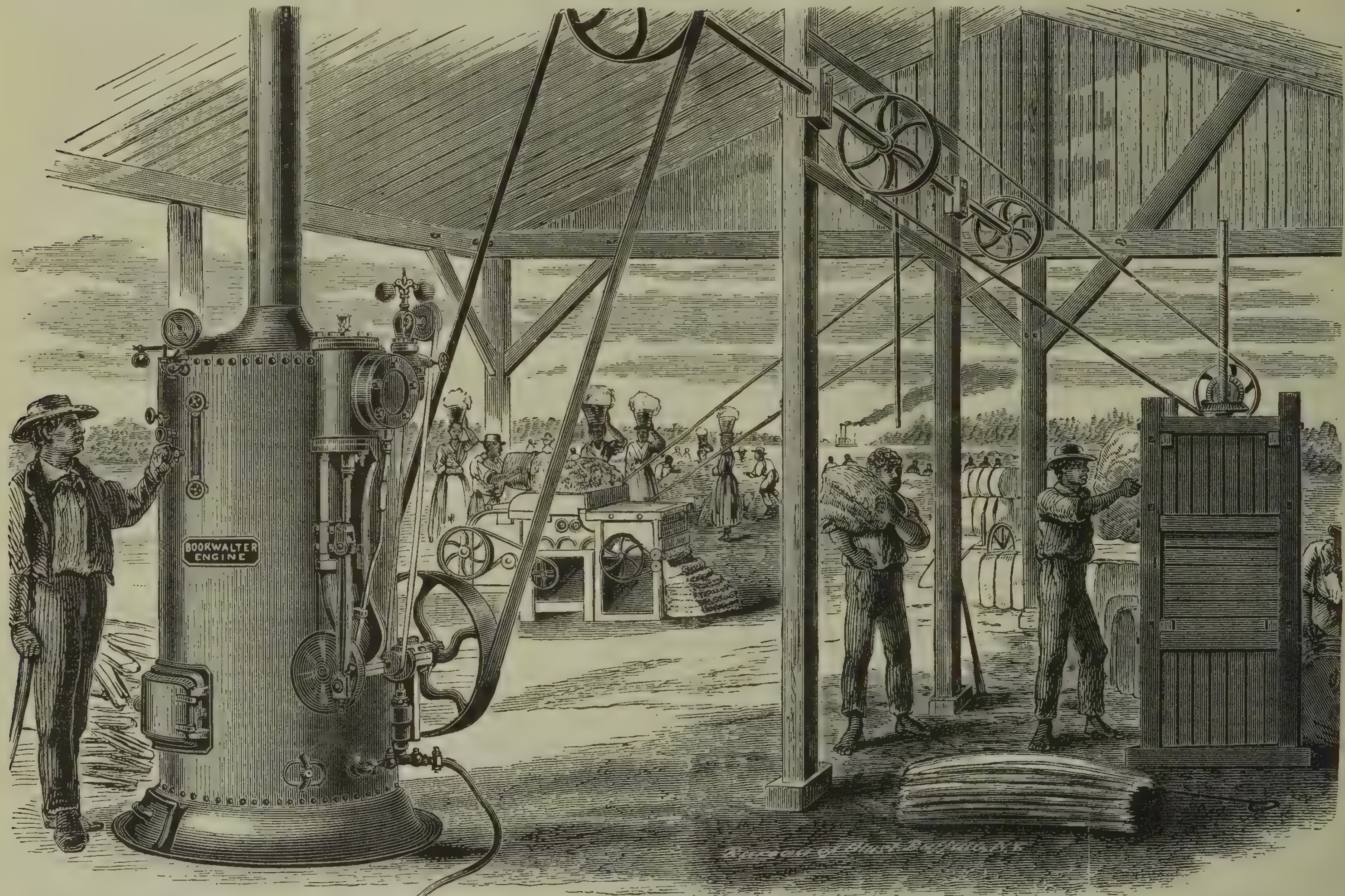
Prof. Cleveland Abbe, one of the officers of the United States Signal Service, and an eminent authority in meteorology, places a low estimate upon the weather prophecies made by individuals. Referring especially to Mr. Vennor, who has gained considerable notoriety by reason of the verification of his prognostications, Prof. Abbe is reported to have declared that the Signal Service authorities in Washington have taken the trouble occasionally to test the accuracy of his work by comparing his predictions with the facts. They find, according to Prof. Abbe, that about one quarter of his predictions are verified, if they are intended for the St. Lawrence valley; and if intended to cover a wider field, then less than ten per cent of his prophecies come true.

Prof. Abbe professes ignorance of Vennor's method of foretelling the weather, but suggestively remarks that there are several ways in which a comparatively truthful guess can be made at the weather for months ahead. One of these is by observing the average weather during each month for a long period. Thus if the average weather for several months, has been wet or cold, it is tolerably safe to predict that during the months immediately following the weather will be the reverse—that is, dry or warm. Again, he explains, when January, February and March have certain characteristics, the latter months of the year—October, November and December—will have corresponding characteristics. By such methods as these, the weather may be foretold in a general way some months ahead. But no man in the world, says Prof. Abbe, has ever devised a plan which will foretell special storms on certain days, or which will enable a genuine prediction to be made for a long period in advance.

The New York *Herald* predictions, in the professor's opinion, are scarcely more trustworthy than those of Vennor. He asserts that during the first months of that service a careful comparison of the *Herald* predictions with the weather in Europe, showed that not more than 17 per centum were actually verified. Giving the *Herald* bureau the benefit of all cases that may be considered doubtful, about 40 per cent of its predictions come near the truth. This estimate has been arrived at very accurately by the independent investigation of the London Meteorological Office. Prof. Abbe thinks that "this is really no better than could be done by guess work."

The Bookwalter Engine.

There are many mechanical and manufacturing operations and processes where the need of moderate power in portable and compact form is indispensable; and to meet the wants of those engaged in such operations as, for example, wood-sawing, running cotton-gins, plantation corn-mills, cheese factories, elevators, printing-presses, grinding mills, pumping water, a great variety of farm work, and, in fact, for all light manufacturing purposes, the engine shown in our illustration has been specially designed. A glance at the engraving, which represents the engine driving a cotton gin and press by belts attached to pulleys on line shaft, shows that its design is the one which experience has proved to combine the maximum of power within the minimum of space, where the requirement of ready portability must be realized, together with simplicity, durability in service, and cheapness. The boiler is of the upright tubular pattern, constructed with special reference to the above named requirements, and the bed-plate, engine and its accessories are attached to it in the simplest and firmest manner, with special care to obviate as far as possible any effects of expansion in the working parts from the heat of the boiler. All the working parts, including also grates, bed-plate, door and bonnet to the boiler, are made in duplicate, and can be readily replaced should they be required, without needless delay. The manufacturers test every machine before it leaves the shop, so that the purchaser may reply upon its safety and perfect working order. The makers are James Leffel & Co., of Springfield, Ohio, and 110 Liberty St., New York city.



BOOKWALTER ENGINE DRIVING COTTON GIN AND COTTON PRESS BY BELTS ATTACHED TO PULLEYS ON LINE SHAFT.

Action of Vegetable Acids on Tin.—Professor Chas. E. Munro of Annapolis states that the ordinary fruit acids, such as those contained in apples, tomatoes, rhubarb, lemons, etc., all act upon tin. Some cider which he examined, and which had been stored in a tin fountain, contained 117 milligrammes of metallic tin to the liter in solution. One case was given where persons eating fruit preserved in tin cans were made violently sick, and tin only was found in the fruit. Corrosion of tin pipes by water was referred to, and it was suggested that the corrosion was due to the vegetable acids in the water.

The Use of Bessemer Steel Increasing.

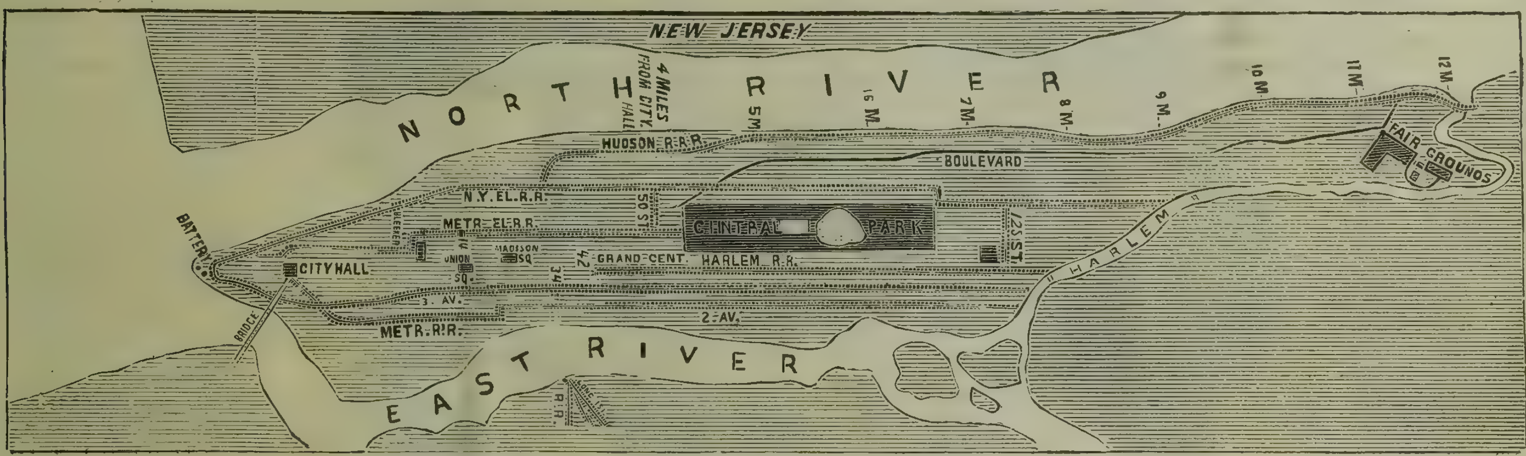
The Sheffield correspondent of the *Ironmonger* writes as follows: The use of Bessemer steel in the Sheffield trades is steadily on the increase, and firms who a few years ago would have felt themselves almost contaminated by having such material on their premises, are now ordering it by hundreds of tons. One producer of it has hazarded the statement that nine-tenths of the cutlery now made in the town is from Bessemer steel. That may be a slight exaggeration, but there is no doubt whatever that immense quantities of carvers and table cutlery—both knives and forks—matchets and similar cutting implements are now being made from this steel. Its use is also steadily extending in the file trade, and houses "who would not use Bessemer steel on any account," are now working up tons of it every week. They fully believe that the quality they use is much preferable to common cast steel; but they conceal the fact of its use, they say, because customers have a prejudice against it. One result of the growing use of Bessemer steel, is that while the houses who supply it are rapidly extending their business, the firms producing the cheaper descriptions of cast steel are going to decay. One young firm is mentioned as sending out now on an average every month 150 tons of Bessemer spring steel, rolled to different sizes. On the other hand, an immense proportion of the melting holes at the furnaces which formerly supplied common cast steel, are now idle. As to the converting furnaces, they are rapidly falling into disuse. There were four of them at the Atlas Works, but they, it is stated, have been swept away, and the ground they occupied devoted to a more useful purpose. At some other works in the same neighborhood, where there are upwards of twenty converters, seldom more than one or two are in use. A good reason, perhaps, for the improving demand for Bessemer steel, is its extreme cheapness. Merchants are asking for iron from \$32.50 to \$35 per ton; Bessemer billets of guaranteed temper can be purchased in lots of not less than 5 tons for \$32.50 per ton. Up to recent times Bessemer steel was only used as a substitute for the commonest brands of cast steel; and it was produced as cheaply as possible. It was cast in ingots, subjected to a chemical test, then reheated and reduced to billets and rolled by one single stage. A demand is now springing up for a better class of this material, to cost at the present time from \$40 to \$45 per ton; and there is a growing belief among the makers of it that it will eventually supersede almost every class of cast steel that is made, except the very best. The prejudice that has hitherto existed against Bessemer steel is gradually being broken down, and not only in the production of cutlery and edge tools, but in the manufacture of our railway material, and so forth, it is now freely used. Confidence in its utility and adaptability is being established. Having regard to the general condition of trade, the demand for Bessemer steel is very good, and the leading houses have orders on their books that will keep them engaged for some time to come.

Occlusion of Gases by Metals.—M. Dumas finds that not only do iron and silver possess the property of retaining large amounts of gas for an indefinite period, but that aluminum and magnesium also have the same property. For equal weights, magnesium contains a volume twice as great as aluminum; but magnesium is so much lighter than aluminum that it will hold only one and a half times its own volume. Silver seems to prefer oxygen; aluminum and magnesium, hydrogen; each metal appearing to have its individual preference.

The Proposed World's Fair of 1883.

Since our last editorial comments upon the prospects of the contemplated World's Fair of 1883, we have nothing to communicate upon which we might base the assurance that the enterprise will be pushed to a successful conclusion. Several meetings of committees have been held, at one of which Gen. Grant was chosen to be President of the Commission.

Now that a site for the buildings has been practically agreed upon, it behooves the Commission forthwith to set themselves to the task of organization if the exhibition is to be held at the time now contemplated. There is no time to spare. The most important—we may say the all-important—thing to do first of all, is to raise the funds necessary for the undertaking; and from the experience of our Philadelphia neighbors, it may be safely assumed that the bulk of the five or six millions that will be required will have to be contributed by public-spirited citizens of New York; and under such circumstances the task of raising the necessary subscriptions, and the control and responsibility for its distribution, should be delegated, if it has not already been done, to a special Board of Finance, composed of the best citizens of the metropolis. If the Commission are wise, they will profit by the experience of their predecessors in 1876.



MAP SHOWING LOCATION OF PROPOSED WORLD'S FAIR OF 1883.

The success of the Centennial Exhibition was seriously imperilled in the incipiency of the enterprise by the disposition of the Commissioners appointed by the government to assume control of the financial business, the manifestation of which brought about a serious conflict of authority between the local committee, through whose efforts the bulk of the money required for the exhibition had been raised, and the Commission, which was happily averted by the latter finally recognizing the right of those who had raised the funds to control and spend them.

The Commission will exhibit wisdom by profiting by this experience. The present project has not the same measure of popular enthusiasm to favor it as the Centennial, and the delays that have hampered the progress of the enterprise thus far have been somewhat unfortunate. But these are not substantial objections, and if taken energetically in hand, the World's Fair of 1883 can be made a magnificent success.

At the last meeting of the Commission, Architect Schwartzmann presented a set of elaborate plans for the buildings and surroundings at the Inwood site. The area of the grounds embraces 250 acres; the length of the enclosure is about 3 miles; length of avenues, 2.80 miles; length of wagon and foot ways, 6 miles; length of tracks for handling of freight, 1.8 miles; length of tracks for transference of passengers within the enclosure, 2 miles; area covered by buildings, 76.3 acres. The Industrial Palace proposed by this plan is 2,262 feet long and 525 feet broad; the Machinery Hall, 1,750 feet long and 500 feet wide; the Art Gallery, 760 feet long by 360 feet wide; the Agricultural Hall, 1,250 feet long by 400 feet wide; the Horticultural Hall embraces 0.74 of an acre; the Rotunda will accommodate 10,000 persons; the Women's Pavilion embraces 0.46 of an acre; and 12 entrances are provided into the grounds.

The engraving shown herewith gives a general view of the location of the site, and a general idea of the means of access from the city. We shall report to our readers from time to time the progress of this enterprise.

The Chicago Police Alarm System.

Mention has been made in this paper, says the *Scientific American*, of the system of telegraphic alarms recently adopted in Chicago for police signaling. Sixty days' trial of the system in the Twelfth street district has convinced the city authorities of the advantages of the system, and it is now proposed to extend it to the West lake street district, covering an area of over four square miles.

The public alarm-houses, as described by the city Chief of Police, are built of wood, and just large enough to admit a man. They are placed upon the sidewalk, as near to street corners as practicable, and securely fastened either to telegraph poles or to corner stores. The keys to such houses are uniform; they are furnished to respectable citizens upon application at the station, and a record kept of the names of the keyholders. A mechanical alarm to register the location of the complaint is inclosed in a small box attached to the side of the house, which box also incloses a telephone for the use of the officer traveling that particular post, and which places the officer in direct communication with his commander at the station. The citizen who possesses a key can, by pulling down a lever which protrudes through a slit outside the box, procure the attendance of three policemen and a horse and wagon in from one to four minutes after entering the alarm-house. The wagon carries a stretcher, blankets, shackles, handcuffs, etc., and can be used either as an ambulance or conveyance for prisoners. The alarm-houses are furnished with patent locks, which, after opening, retain the key until an officer arrives with a master key, which he inserts in the reverse side of the lock and releases the original; this precaution is taken to prevent false alarms, and to keep the complainant at the alarm-house until the officers arrive to hear the complaint and apply the remedy. A large bell will be procured and erected upon each station, and at a given signal each officer in the district will be required to report immediately at the alarm-house upon his post, so that if any serious crime be committed in the district the officer in command at the station can summon each man on post duty, and telephone to his whole command at once, giving information to his men of the crime committed, and, if known, a description of the criminals, thus putting each patrolman on the alert to arrest the suspected parties.

In addition to these public alarm stations are private boxes combining police and fire alarm calls, which are to be placed in stores, offices and dwellings at a cost of about $30 each. These boxes are so small that they can be set in a wall, behind a desk, or under a counter, and a noiseless alarm given, which will not disturb the thief or swindler until the officers arrive to make the arrest. Fire alarms can be given in the same manner, and registered at the headquarters of the Fire Department in one second after the alarm is turned in.

High Speed Engines.

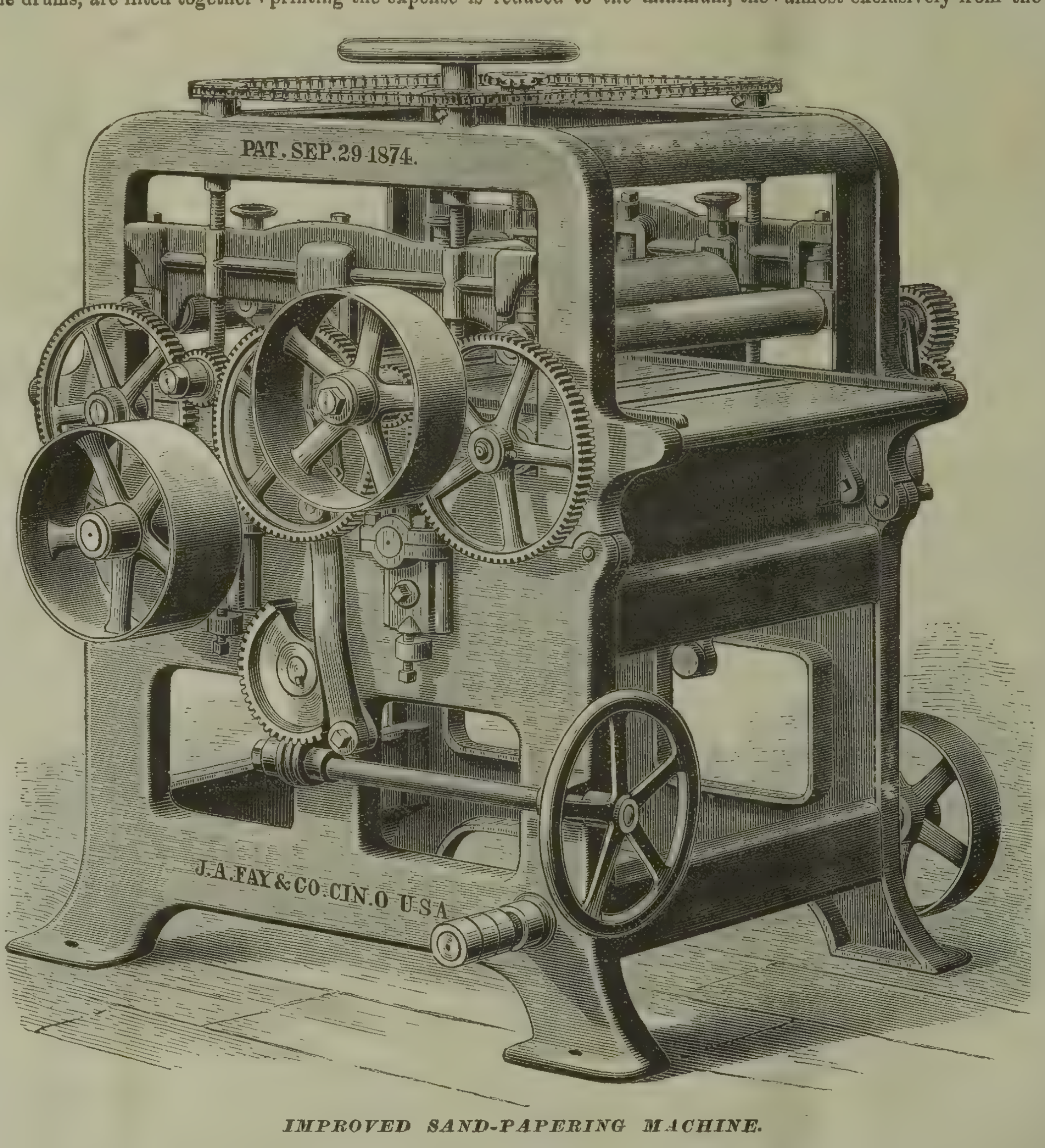
The general tendency seems now to be in the direction of a horizontal engine with a stroke of medium length, having a rapid piston speed, and a rapid rotation of crank shaft, rather than a longer stroke with a less rate of revolution. This rapid movement of piston and crank-shaft permits the use of small fly-wheels and driving-pulleys, and thus very materially reduces the cost of an engine for a given power. To illustrate this, it may be said that a 16×48-inch engine, using steam at 80 pounds pressure, and cutting off at one-quarter stroke, running at the rate of 60 revolutions per minute, may be replaced by an engine having a 13×24-inch cylinder, running at the rate of 200 strokes per minute, the pressure of steam and point of cutting off remaining the same, both engines being non-condensing, and representing the best examples of their kind. The difference between 60 and 200 revolutions per minute in millwright work is very great; but there is a constantly growing demand for an engine which shall meet such a requirement whenever it shall present itself. By this is not to be understood an engine which shall be used at either speed indiscriminately, but rather a type of engine which shall be economical in fuel, and shall be of a kind by which the rate of revolution may be such as to suit the millwright's work without loss of economy in working, and without excessive outlay for the engine itself in proportion to power developed. Slow-speed engines are designed and built from a standpoint entirely different from that of high-speed engines; in the former case the reciprocating parts are made as light as possible consistent with safety. The fly-wheel is large in diameter, and made with a very heavy rim; especially is this the case with automatic cut-off engines of long stroke and slow revolution of crank-shaft. In high-speed engines the reciprocating parts are often of great weight, in order to insure the utmost smoothness of running. The piston and cross-head are made of unusual weight, that at the beginning of the stroke they may require a large part of the steam pressure to set them in motion. This absorbing of power at the beginning of the stroke is for the purpose of temporarily storing it up in the reciprocating parts that it may be given off at the latter portions of the stroke by imparting their momentum to the crank; thus at the beginning of the stroke these reciprocating parts act as a temporary resistance, but once in motion, they tend by their inertia to equalize the pressure on the crank-pin, and so produce not only smooth running, but a very uniform motion.

A Simple Adhesive for Rubber Belts is made by sticking powdered chalk, which has been evenly sprinkled over, to the surface of the belt by cold tallow or boiled linseed oil.

Improved Sand-Papering Machine.

The illustration given herewith represents a sand-papering machine of improved construction, manufactured by the well-known firm of J. A. Fay & Co., of Cincinnati, Ohio, builders of wood-working machinery. The machine in question is specially designed to meet the requirements of car-building shops, for a machine which would expeditiously finish lumber to a perfect surface for receiving paint or varnish. It may be described as a six-roll, double-drum sand-papering machine, with expansive rolls and vibrating cylinder. It will take stuff 24 inches wide by 4 inches thick. The feed is powerful and continuous, consisting of six rollers, arranged in pairs, driven by strong train gearing, and constructed to expand to 4 inches in thickness. The feeding rollers in the upper frame, with the pressure rollers over the drums, are lifted together in a plane by the movement at once of four raising screws, operated by a chain and hand-wheel. The lower feeding rollers are set in the lower frame, and remain always perfectly in line with the drums. The sand-paper drums are placed in the body of the machine, upon which the lower frame rests, and are driven in opposite or the same direction, as may be necessary. The finishing drum has a vibratory lateral motion, to remove continuous lines from any inequalities in the sand-paper. The lower frame is hinged at each end, so that by removing a pin either drum end may be reached by raising the frame with the screw and worm gear, operated by a hand-wheel at the end of the machine.

These machines are largely used in car-shops and planing mills throughout the country, and, as may be said of all machines produced by this firm, are excellently adapted for their intended uses. The makers will furnish further particulars on application.



IMPROVED SAND-PAPERING MACHINE.

Multi-Color Printing Press.

A multi-color printing press was exhibited at the late fair of the American Institute, which in a very satisfactory manner performed the task of printing, with a single form and at a single impression, a number of colors. This has always been looked upon as a great desideratum, and many attempts to devise a practical multi-color press have been made. In the present case, the peculiarity of the press resides in the special construction of the inking table, which, instead of consisting of a single piece, is composed of a number of cast-iron plates held in a frame. The various colored inks are contained in a suitable trough divided into a number of cells. A metallic frame, which can be properly adjusted, is placed upon the trough to prevent the inks from mixing. The different inks are spread upon the plates in the usual manner by inking rollers, arranged to run perfectly straight, and the distribution is assisted by the peculiar construction of the plates, which permits them to have a slight lateral movement at each revolution of the press. The press can be used at pleasure for single or multi-color work, by removing the ordinary inking table and substituting the sectional table in its place.

With this machine a demi-octavo prospectus may be readily printed in eight colors at a single impression, each color being clear and distinct from the others, for the rollers, moving at right angles with the axis of the press, the inks do not mix, and the plates may be brought as near together as may be required for the work in hand. This system of multi-color tables may be applied to a variety of presses; and it is confidently anticipated, when its merits become known, that it will come into very general use. For printing circulars, advertisements, bills of fare and the like, the method specially recommends itself.

It is obvious that with this system of multi-color printing the expense is reduced to the minimum, the only difference in this respect between it and the common method being the extra cost of the inks. We have seen a number of samples of color-work executed upon the Bacon press (as it is called), which fully bear out the claims made for it. Further information will be given by Mr. T. Sarony-Lambert, Room 5, Bennett Building, this city.

Artificial Vanilla.—The production of any well-known substances artificially by the synthetical chemist, is generally viewed by the public with opposition, until convinced that it is identical with the natural product. A German paper produces an endorsement of artificial vanilline by Prof. Meidinger, who says it possesses undeniable advantages over natural vanilla. The latter loses its aroma, is unequal, and the natural bean only contains 2 per cent of valuable material, with 98 per cent of worthless or even injurious material, of which the removal is troublesome and tedious, before the pure flavor can be obtained. In Germany the vanilla is mixed with sugar, and put in packages of different strength for different purposes. That for chocolate manufacturers is 70 times as strong as good vanilla; that for family use is put up in packages equal to one bean, and sold at 9 cents each; that for liquor manufacturers, 2 per cent of vanilla. Dr. Meidinger speaks very highly of this artificial vanilline, which he pronounces perfectly wholesome.

The Manufacture and Uses of Nitric Acid.

Next to sulphuric acid in the extent and importance of its applications in the arts and manufactures, we may safely place nitric acid—the *aqua fortis* of the early chemists. This acid is manufactured on a commercial scale in enormous quantities, and of late years almost exclusively from the so-called Chilian saltpeter—a nitrate of soda—by decomposing this salt with sulphuric acid. By this treatment the nitric acid is set free, and is collected by condensation in vessels provided for the purpose. The vast expansion that the chemical industries have attained, have made the deposits of soda niter that occur abundantly in Chili and Peru, enormously valuable, as this material is the cheapest source of nitric acid that has yet been discovered, in consequence of which the exportation of the product to Europe and to this country has become one of the leading industries of those countries.

We illustrate on the opposite page the method of manufacturing this important chemical product in one of the leading chemical manufactories of the United States (that of Martin Kalbfleisch's Sons, whose works are located in Brooklyn, N. Y.; Bayonne, N. J.; and Buffalo, N. Y.)

For the manufacture of nitric acid, a series of cast-iron vessels are provided, suitably mounted over furnaces, so that they may be heated. This construction is shown in Fig. 1. These vessels are charged with a quantity of the before mentioned Chilian saltpeter, to which is then added an equal weight of strong sulphuric acid. The chambers are then closed and the fires started. The sulphuric acid speedily attacks the niter, displacing the nitric acid, which is liberated in the form of vapor, and forming a bisulphate of soda as the product of the decomposition.

From the rear of each oven a clay-lined pipe projects, which conducts the vapors of nitric acid, as they are given off, into a set of stoneware or glass receivers, the latter being connected with each other by means of earthenware or glass tubes. The acid condensed in the receivers nearest to the ovens is highly concentrated. That which is condensed in the others is weaker, because in order to condense all the acid given off, some water is introduced into the following ones; the product condensed in these is, therefore, more dilute than that obtained in the others.

Sometimes, instead of the iron vessels above named,

the manufacturers employ a series of glass retorts, placed upon a sand-bath, heated by a fire below, as shown in Fig. 2 of our illustrations. The subsequent

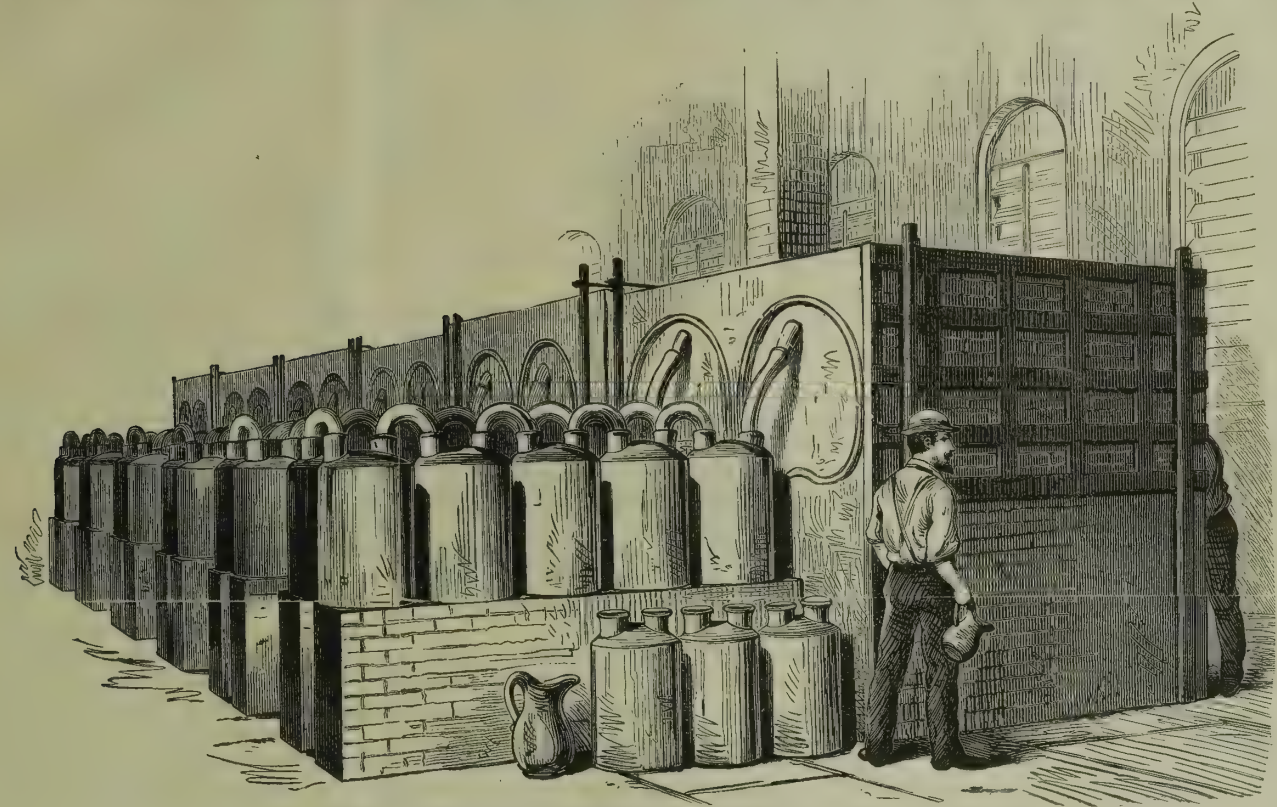


Fig. 1.—CHAMBERS AND RECEIVERS.

operation of condensation in a series of connected vessels, however, remains the same as above described. The proportion of materials employed to produce the best results should be 17 parts of nitrate of soda to 14½ parts of strong sulphuric acid.

The nitric acid obtained in the above operation, properly conducted, is a colorless, transparent liquid, having a specific gravity of 1.55 (water = 1), and boiling at 176° Fahrenheit. When diluted with water the boiling point is higher. An acid containing 100 parts dry acid and 50 parts water boils at 264.2° Fah., but if the dilution with water is continued further, the boiling point is again lowered, consequently when such an acid is heated above 212° Fah., the first product of the distillation is water, containing only a trace of acid; and if the process be continued, the boiling point gradually rises until it reaches about 264° F., at which point, what is known to the trade as double aquafortis, passes over, which has a specific gravity of from 1.35 to 1.45, while ordinary, or single aqua fortis, has a gravity of 1.19 to 1.25. In contact with the air, nitric acid gives off fumes, owing to the absorption of moisture from the atmosphere.

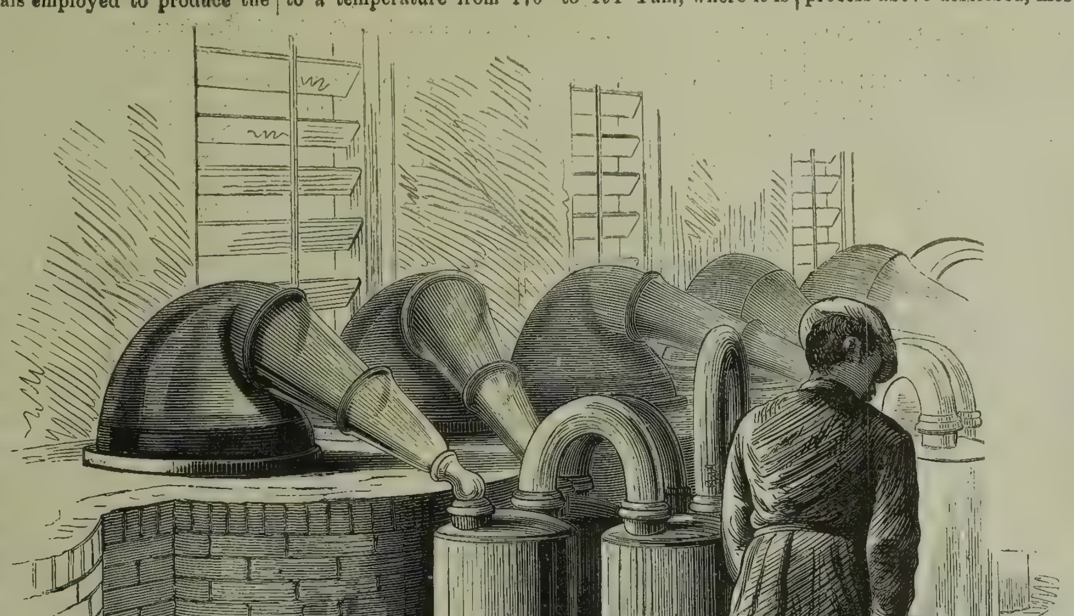


Fig. 2.—CONCENTRATING STILLS.

The strongest acid made in the process here described is usually of a yellow color, owing to the presence of lower oxides of nitrogen (hyponitric acid). To get rid of this, the acid is bleached by exposing it for a time, in suitable glass vessels, on the water-bath to a temperature from 176° to 194° Fah., where it is left until colored fumes cease to be given off, and the acid remaining in the vessels is colorless. If the acid is required to be very pure, the first products coming over are collected in a separate vessel. This will contain most of the hydrochloric acid which may be given off, if the nitrate employed contains chlorides, which it usually does in small quantities. In the bleaching process above described, most of the hydrochloric acid is removed from the acid product as chlorine. To still further purify the product, it is necessary to remove the small quantities of sulphuric acid carried over mechanically from the still. This is effected by distilling the nitric acid over pure nitrate of baryta, while the last traces of hydrochloric acid are removed by distillation over pure nitrate of silver. These last operations are only performed when it is desired to have the nitric acid chemically pure for analytical purposes, but are not carried out in commercial productions.

The residual product remaining in the chambers, or retorts, is a bisulphate of soda, used for the production of fuming sulphuric acid by subjecting it to a red heat, and condensing the acid fumes given off; or it is mixed with common salt and ignited, when muriatic (hydrochloric) acid is evolved, which is collected, and a neutral sulphate of soda remains behind, which can be utilized for the manufacture of soda by the common method, or for

other purposes. The uses of nitric acid are extensive, and important both in the laboratory and in the arts and manufactures. Its usefulness is derived from the property which it possesses of yielding very freely a notable proportion of its oxygen to substances having an affinity for the same, a property which renders it one of the most energetic of oxidizing agents. On this account, as well as because of its cheapness, its use for oxidizing purposes in the laboratory is very extensive.

We append below a list of the more important technical uses of nitric acid: Its property of energetically dissolving many of the common metals, renders it useful in etching steel, copper, bronze and the like. In the manufacture of sulphuric acid, it is introduced for the purpose of effecting the oxidation of the sulphurous acid given off in the burning of sulphur, or the roasting of pyrites, to sulphuric acid. It has the property of yielding, with certain organic substances, what are called nitro-compounds, which are of great value in the arts. So, for example, nitro-cellulose (gun-cotton), nitro-glycerine, nitro-benzole, nitro-mannite, and a number of analogous products are formed. Owing to its powerful oxidizing action, it acts powerfully upon coloring matters, and on this account has some important applications in dyeing. By prolonged treatment with nitric acid, starch, cellulose (wood fiber), and sugar are converted into oxalic acid; very dilute acid converts starch into dextrine. The fact that it will not attack gold, while energetically dissolving nearly all the other metals, has long been taken advantage of in the arts, in assaying and metallurgy, to separate gold from silver and base metals.

Nitric acid is employed in the chemical industries in great quantities in the manufacture of an immense number of chemical products, in addition to those we have already named. Of these, some of the more important are, the preparation of picric acid from carbolic acid, naphthaline yellow from naphthaline; the manufacture of nitro-benzole, nitro-talual, and phthalic acid; the preparation of nitrate of silver (lunar caustic), arsenic acid, fulminate of mercury, and, generally speaking, of the salts known as nitrates.

From the above, it will be seen that nitric acid is one one of the most important chemical agents employed in the arts and manufactures.

The American Iron Trade.

According to the report of the Secretary of the American Iron and Steel Association, the American iron trade for the year 1880 was quite active and satisfactory. The United States made in the past year, 3,300,000 gross tons of pig iron, as against 2,741,853 tons in 1879. These figures indicate a consumption of about 4,000,000 tons in 1880. The production of rails during 1880 is estimated at 1,200,000 gross tons, as against 993,993 tons in 1879. Of the total for the past year, 775,000 tons were steel rails, and 425,000 iron. The consumption for 1880 was, approximately, 1,475,000 tons.

The past year witnessed quite a revival in the extension of our railway system; the amount of new track laid being estimated at about 6,500 miles, as against 4,725 miles in 1879. The figures of 1880 are, with one single exception, the largest in the history of railways in this country.

It is yet too early to give accurate statistics of our iron trade during the year just past, but the approximate figures given above indicate that the year has been a very prosperous one to iron masters and manufacturers.

A Hint to Employers.—Every workshop and factory should contain at least one good thermometer, and this should be placed in some conspicuous place, where all in authority may see it. It should be consulted, and its warnings noted. Employers who value the health and energies of their workmen will endeavor to keep the average temperature of their workshops at about 65 degrees. Men will be more cheerful, much healthier, and do more work at this temperature than at any other.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

In 64th street, near Madison avenue, a small chapel is nearly completed.

Several tenement houses are to be erected on Avenue A by speculative builders.

Building operations continue very active, especially in the district east of Fourth avenue and north of 59th street.

The Church Extension Society is building a small but expensive church in 71st street, near Eighth avenue.

A coöperative association intends to build a first-class apartment house on the northwest corner of Madison avenue and 28th street.

The Church of the Holy Spirit intend building an edifice on the corner of Madison avenue and 66th street, which will cost over $60,000.

John Sloane has recently bought a plot of land, 33 by 175 feet, on the east side of Fifth avenue, on which he intends building a dwelling for his own occupancy, at a cost of $100,000.

J. & G. Ruddell are about starting four first-class brown stone houses on the north side of 73rd street, adjoining Quintard's new mansion on the northeast corner of Fifth avenue and 73rd street.

At 110th street, near Madison avenue, a large stone church is being built by the One Hundred and Eleventh Street Methodist Episcopal Church. This church will seat over 600 persons, and will cost $45,000.

A six-story brick and limestone apartment house, 75x96 feet, is to be erected at the southeast corner of 63rd street and Park avenue, to cost $100,000. The owner is Thomas Kilpatrick, and the architect C. W. Romeyn.

Harrigan & Hart, now occupying the Theater Comique, intend to erect a new theater on the site of the present Globe Theater, opposite the New York Hotel. It is to seat 1,400 persons and cost $125,000. Kimball & Wisedell are the architects.

Reports are numerous as to proposed new buildings to be erected in various parts of the city, though definite information cannot be obtained. Among the projects are new building on the corner of Broadway and Franklin street, and Broadway and Duane street. For Boston owners a new store is to be erected on Beaver street. The plans for Wallack's new theater will soon be ready.

A remarkable number of handsome churches are now being built in the upper part of the city. At 111th street and Lexington avenue is the Second Baptist Church of Harlem, nearly completed, a beautiful brick edifice. The cost of the building and lot will be $51,000. The church is light and pleasant, and will comfortably seat 500 persons. The pews are finished in ash and cherry. The organ and choir will be behind the minister.

R. L. Stuart intends to build a splendid dwelling house on Fifth avenue at the north corner of 68th street. The front will extend perhaps 200 feet along Fifth avenue. The side on 68th street will measure 100 feet, and the garden behind the house, also bounded by the same street, will extend 150 feet further back. Six architects have prepared plans for the house. The porch and main stairway have received particular attention from Mr. Stuart, who wishes these parts of his residence to surpass anything of the kind yet built or designed in New York. Polished Aberdeen granite columns will cluster about the entrance.

The old office and block of houses erected by John Jacob Astor, the grandfather of the present John Jacob Astor, on Prince street, extending from Broadway to Mercer street, is being pulled down to make way for two stores, which will have a frontage on Broadway of 50 feet, immediately opposite the Metropolitan Hotel, and extending to Mercer street—200 feet. They will be built of brick and stone, with Ohio stone trimmings, at a cost of $350,000. There will be no stores, as heretofore, on Prince street. Like all the buildings belonging to the Astor estate, they will be constructed in a plain and substantial manner, and rented exclusively for mercantile purposes.

Miscellaneous.

A county jail to cost, $20,000 is to be erected at Duluth, Minn.

A court-house to replace the present building is to be built at Howell, Mich.

A brick jail is to be built at Charitan, Iowa, to cost $12,000, of which B. T. Bartlet is architect.

A brick jail building, to cost $10,000, is to be built at Indianola, Iowa. The architects are Blake & Lee.

Geo. W. Childs and Anthony J. Drexel, of Philadelphia, intend to build a hotel and a number of cottages at Deal Beach, N. J., in time for next summer's visitors.

A court-house is to be built for Schuyler county, Ill., at Rushville, that State. It will be of brick and stone, and will cost about $40,000. E. O. Fallis, of Toledo, Ohio, is the architect.

Plans are being prepared for an astronomical observatory for the United States Military Academy at West Point, N. Y., by Wilson Bros., architects and engineers, Philadelphia.

An insane asylum, to accommodate 400 patients, is to be built at Salem, Oregon, at a cost of $150,000. Six plans, all by architects of Portland, have been submitted, but a decision has not yet been declared.

A hotel, to cost $200,000, is to be built at El Paso, Tex. The architect is Wm. Goodrich, of Denver, Col., who has also completed designs for a hotel at Merrilla, New Mexico, to cost $85,000, and one at San Marcial, in that State, to cost $100,000.

There is a steady increase in building operations throughout the country. In San Francisco, after a long period of inactivity, building operations have begun with much energy, and it is said that the present year will see more structures completed than the preceding five years. In Boston the past season has been unusually active, but the indications are that the next will not be less so; and Chicago also shows, with a great increase in general business, a corresponding movement in the trades connected with construction. This hopeful state of affairs should suggest to those who are in a position to make their influence felt in such matters, the importance of promoting those modifications in street lines, or improvements in construction, which a wise foresight may suggest as best adapted to give the highest and most permanent value to the buildings which the coming years will see erected.

The discussion of the question of homes for families of moderate means has induced Jackson S. Schultz, Robert M. Strebeigh, and T. F. Thomas, trustees of the estate of Abner Chichester, to try the experiment of building a number of small brick houses adapted to the needs of single families, and to offer them at a small interest upon the cost. In their possession was a piece of ground in Brooklyn covered with dilapidated frame houses. These have been swept away, and in their places thirty-four two-story brick houses have been built. They occupy three sides of the block bounded by Tillary, Raymond, and Sycamore streets. The houses are all similar in design. The ground plan occupies a space of 32 feet by 12½ feet. Through a small vestibule one enters the parlor, a cozy room, 10 by 11 feet, finished in painted wood, with oak mantel and gas fixtures of a pretty pattern. In the rear is the dining room, a little larger in size, but of the same finish, and with set marble basin and running water. Between the rooms is the hall, containing the stairway and a closet. The second story comprises two bedrooms, each having a closet and running water. In the basement is a large cellar and a kitchen with range, hot and cold water, stationary tub, and other modern improvements. There is ample yard room, some of the yards having a depth of over 50 feet. The rent for an entire building is $18 per month.

Korting's Universal Injector.

The subjoined engravings illustrate external and sectional views of a combined pump and boiler feeder, which, under the name of Korting's Universal Injector, has attained a wide and deserved reputation as an effective and reliable instrument for feeding boilers of all kinds. As evidence of the utility of this instrument, it may be noticed that at the present time there are over 11,000 of the Universal injectors in use throughout the United States and Europe.

Of the cuts, Fig. 1 shows an exterior and Fig. 2 a sectional view of the instrument. The makers of this injector claim that it will work with equal effectiveness whether lifting water or under pressure from street mains or from tanks, feeding under any variation of steam pressure, and taking water from the lowest to the highest practicable temperature (say 150° Fah.)

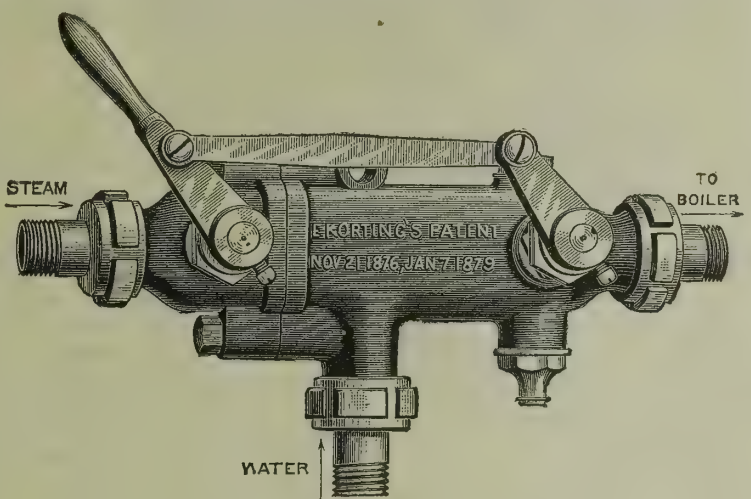


Fig. 1.—Korting's Univrrsal Injector—Exterior View.

As will be observed by an examination of Fig. 2, the instrument is a combination comprising a duplex steam jet apparatus. The first of these, the lower one in the cut, is so proportioned that it shall lift and deliver the water under any given pressure into the second or upper one, by which its velocity is sufficiently augmented to enable it to overcome the counter pressure of the boiler; feeding through heaters if desired, or heating the water to a high temperature without a heater. The explanation of the effective working of this injector, at the lowest as well as the highest steam pressures, without any adjustment of parts, is found in the fact that the quantity of water taken in by the lower nozzle and delivered to the upper one, is directly in proportion to the pressure of the steam, so that the lower one acts as a governor for the upper one. The simplicity of the apparatus is demonstrated by the fact that it is operated from a single lever, which acts at once as the steam and starting valve, thus obviating the necessity of an extra steam valve. The duplex features of the instrument, and its governing qualities without moving parts, are peculiarities which are especially advantageous. The limits of admissible temperature are stated to be, feed-water 150° Fah. delivered into the boiler, with 150 pounds of steam at 250° Fah. All connections must be air-tight to insure its operation. A check valve is placed in the delivery end of the instrument, thus making it complete in itself.

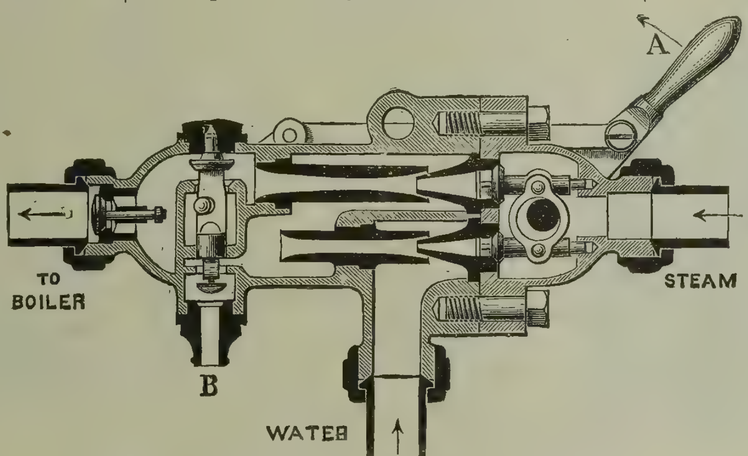


Fig. 2.—Korting's Universal Injector—Sectional View.

The same style of injector can be used on all kinds of steam boilers, and also on locomotives.

For special information not given here, our readers may address A. Aller, 109 Liberty street, New York.

Progress of Engineering in America.

At a late meeting of civil engineers in St. Louis, a very interesting paper was read by Mr. O. Chanute, summarizing the progress and wonderful growth which engineering has made in this country, and alluding to the high position which the United States has attained among nations. From this paper we briefly summarize as follows: In the matter of supplying towns with water, the application of steam as a power, and the improvements made in pumping machines, engineers have made a gain of 50 per cent over what was accomplished twenty years ago. There are now 569 towns and cities in the United States and Canada supplied with water works, involving 13,000 miles of pipe, 10,000 of which are of cast iron. Important progress has also been made in canal engineering, and we now have 3,257 miles of canal.

Experiments are in progress in the way of steam propulsion, which it is confidently expected will effect a saving of fully 37 per cent over present methods. In railways, Americans were among the first to appreciate Stephenson's invention of 1828, and are foremost among nations in utilizing it. The United States leads the world in the extent of her lines, reaching 86,000 miles; all Europe has but 90,000, and the balance of the world only 25,000. Our railroad engineers and locomotive builders lead all others. Our roads reach farther and cost less than any others, and our engines pull heavier trains and run more miles in a year, or during their lifetime, than those of any other nation. The Pennsylvania railroad was pronounced one of the best, if not the best, managed railroad in the world. In regard to bridges, there are now in the United States 900 miles of these structures—one-third of them stone or iron, and two-thirds of wood. The matter of river improvements is just now attracting much attention, and the fact is being realized that, until quite recently, but little has really been done in this direction. It has been demonstrated that the currents of the largest rivers may be controlled by simple brush dykes. The movable dam on the Ohio—a French idea—has already proved a success, and the best engineering talent in the country is now engaged in effecting certain needed modifications required to meet the peculiar nature and needs of our rivers. The recent improvements to navigation at Hell Gate and Flood Rock, New York, were referred to as great and novel feats of engineering. In telegraphic and gas engineering, we have made wonderful strides. In the former, we lead the world; in the latter, since 1850, the number of companies has increased from 50 to 900, with a capital of $200,000,000. In metallurgy, the increase of our blast furnaces is equally notable. In the amount of iron produced, we are next to England, Germany standing third. Our steel industry, which is now second only to that of Great Britain, will exceed that country in another year. Our increase has been 50 per cent in two years. Our mining industry, especially in regard to the precious metals, is simply enormous. The petroleum industry was briefly alluded to. Our exports of that product are now the fifth on the list in point of value. In agricultural engineering, our progress has been truly wonderful, and before this all other branches become as dust in the valley. In the plow alone the annual saving of labor in producing our crops amounts to fully $36,000,000 less than the same work would have cost thirty years ago. It is in ship-building and maritime trade alone that we have lost ground during the last two decades. This decadence is attributed to the war of the rebellion, and to unequal competition with England in ship-building, and the superiority of iron over wood—an industry to which our engineers and capitalists have not given proper attention; but it was confidently predicted that in the early future we shall once more assume our proper place on the ocean.

Iron Rust in Boilers.

The oxidation of iron immersed in ordinary water, says *Engineering*, appears to be largely due to two causes—namely; first, the absorption of oxygen contained in the water, and second, the absorption of oxygen set free during the decomposition of the water, hydrogen being set free in the latter case. M. Lodin, who has made a number of experiments on the corrosion of iron wires immersed in water, and various solutions, and who has described his experiments in the *Comptes Rendus*, has arrived at the conclusion that the first of the above causes of oxidation is generally of the chief importance. With both distilled and ordinary water the temperature has a very important influence. Thus, at 68° Fah. the quantities of oxygen absorbed per square foot of iron surface per hour when immersed in distilled and calcareous waters respectively, were 0.258 grains and 0.330 grains, while at 212° the quantities rose to about 2.364 and 2.579 grains. The immersion of iron in all the waters tested was accompanied by the evolution of hydrogen, the action being least, however, in distilled water. At a temperature of about 260° Fah., the decomposition of the water was found to be equivalent to the absorption of 0.01 grains of oxygen per square foot of surface per hour for distilled water; 0.0129 grains for calcareous water; 0.0182 grains for water containing one-fifth part of crystallized chloride of magnesium; 0.05 grains for water saturated with chloride of sodium; and 0.067 grains for sea water.

Beet Sugar Industry.

From present indications, the beet sugar industry has at length obtained a secure foothold in this country. We learn from current newspaper report that a new sugar mill at Riverside, a short distance from Wilmington, Del., has lately commenced operations, and is now working up 50 tons of green beets per day. The company operating this mill have taken special pains to interest the farmers of the vicinity in the enterprise, and have succeeded in securing their coöperation. They expect this season, with the new and improved machinery introduced, to turn out about 550,000 pounds of raw sugar, 200,000 pounds of molasses, and 1,700 tons of pulp.

The Beet Sugar Company, of Portland, Me., are again at work for the season, employing 125 men day and night, working about 125 tons of beets per day. They expect to work up this year 10,000 tons, and have 6,000 now on hand. The mill has a capacity of

20,000 tons, which could be worked up were the supply of beets adequate.

A new sugar works in Franklin county, Mass., is also stated to have started in operation.

These accounts are very encouraging for the friends of the beet sugar industry.

Contributions to the Understanding of Steam Boiler Explosions.

We present this month for the information of our readers, the history of an instructive case of the explosion of a boiler at Cambridge, Mass., April, 1878, from the records of the Hartford Steam Boiler Inspection & Insurance Co. It was a horizontal tubular, one of the most common in use, and well known to all familiar with steam boilers. It was made for the present owners in November, 1869, was 48 inches in diameter and 17 feet long. All longitudinal seams were double riveted, with the necessary man-hole on top for getting into the boiler for inspection and cleaning it out; and also a hand-hole in the bottom of the front head for cleaning out under the tubes. The shell of the boiler was of best quality C No. 1 iron, $^5/_{16}$ of an inch thick. The heads were of best quality flange iron, $\frac{3}{8}$ inch thick, being well braced, having angle-iron braces riveted to the heads, and stays from thence to the shell. It was furnished with the usual appliances—one safety valve 3 inches in diameter, three gauge cocks, etc., and at its completion was examined and subjected to a hydraulic pressure of 150 pounds per square inch, and considered safe at a steam pressure not exceeding 100 pounds per square inch. [The examination and test were made by the government inspector. The boiler was never under guaranteed inspection.]

Fig. 1.—Wreck of the Boiler House.

The above description is from the report of Inspector Fairbairn, of the Eastern Department.

Of the accompanying illustrations, Figs. 1, 2 and 3 represent the wreck of the boiler and building. They are copies of photographs taken soon after the explosion. The additional engravings are intended to illustrate the theory of the explosion. Fig. 4 is a longitudinal section of the boiler as originally made, omitting the patches which have been put on since, but showing at A the location of the deposit which permitted the iron beneath it to become overheated.

The explosion of this boiler occurred in April, 1878, by which three persons were killed and a number more wounded. An unusual interest was excited by this accident, and a number of experts were called to testify as to the cause of the disaster, and although there was no disagreement among trained boiler inspectors, still there was doubt expressed by one expert witness as to the original soundness of the iron, and the correctness of the construction and setting. The

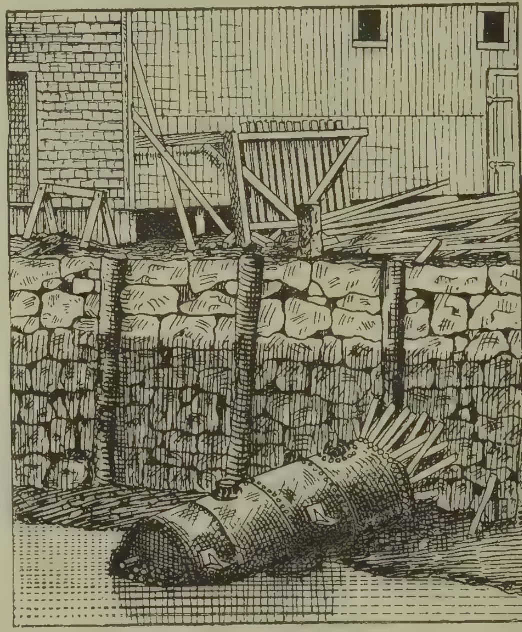


Fig. 2.—The Principal Part of the Boiler in the Canal at Low Tide.

marks upon the plates of the back part of the boiler seemed, from the evidence, to plainly indicate a considerable deposit (A, Fig. 4), and repeated repairs of the bottom of the shell had been made, all rendered necessary from overheating where sediment had prevented contact of the water with the iron. Whatever the character of the iron and the faults of construction may have been, there would seem to have been sufficient warning of approaching disaster to have prompted a greater degree of care in inspection and cleaning.

The boiler was worked at a pressure of about 75 pounds per square inch, and it was allowed to come to repair repeatedly without any inspection, till at last, on the 6th of April, it exploded with destructive force, the larger portion, consisting of about four-5ths of the shell, and containing all the tubes, was projected through the side of the building a distance of 150 or 200 feet into a canal, where at low water it was photographed (Fig. 2).

The initial rupture was undoubtedly at A (Figs. 4 and 5), the iron having been weakened by frequent overheating for a considerable distance along the bottom, and the usual working pressure was sufficient to rend it and allow of the instantaneous escape of the steam, which, owing to its activity, would pass through the mass of water, driving a portion before it, and enlarging the original opening, as shown in Fig. 6, and

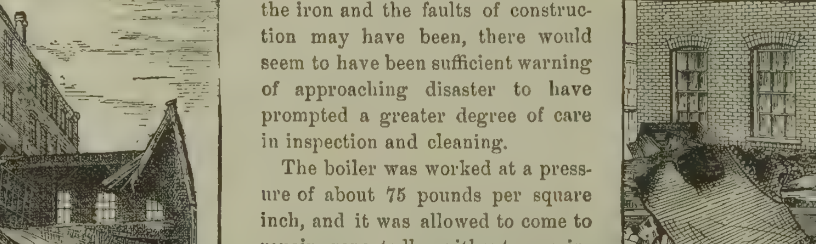


Fig. 4.—Longitudinal Section of the Boiler.

an instant may be conceived in which the water is disintegrated and expanded with such suddenness as to give the character of an explosion; it fills the entire steam-room and water-room, and is projected like a charge from a cannon against the rear head of the boiler, there being little resistance in that direction. The parallel surfaces of the shell and tubes direct the mass of foamy water, which still retains a large percentage of its original specific gravity, and its inertia or momentum carries enough of it past the opening to tear the boiler apart, as shown in Fig. 7, and the principal part takes a rocket-like course, a distance which is determined by the quantity of expanding elements that it contains and the freedom with which it can escape. The process is practically continuous, but eye-witnesses often, at coroner's inquests, have said they heard a great rush of steam followed by a loud explosion.

In this case a doubt was expressed by some of the witnesses as to the probable location of the initial rupture, but none of the practical boiler inspectors who were called expressed the least doubt as to the presence of a considerable deposit at A, Fig. 4. The weakest point, originally, may have been the seam C B, as stated by one expert, owing to faulty workmanship; but when the overheating had so reduced the strength of the plate at A, which has to sustain just double the strain per ring unit (see A B, Fig. A) that it does per stave unit (E F, Fig. A), there would seem to be little doubt in the minds of practical men where the fracture started, even though statistics did not, as they certainly do, clearly show that initial ruptures in shells of this form almost invariably are longitudinal.

The bracing, which was charged by the same witnesses with contributing to the weakness, is not placed in the boiler for the purpose of supporting the cylinder part, but to prevent the bulging out of the flat end-plates or heads, and they are not used or needed on heads that are sufficiently stiff to bear the load

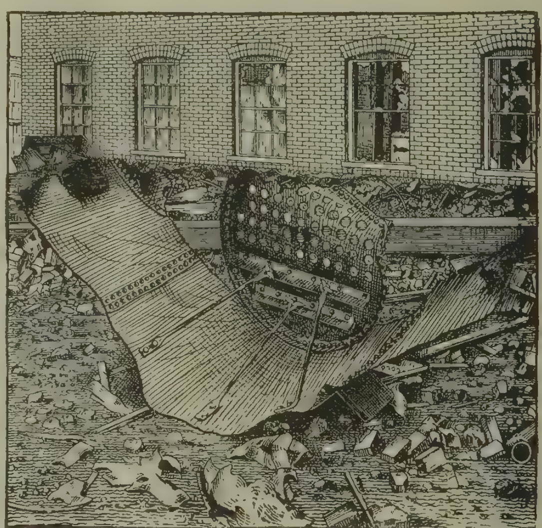


Fig. 3.—The Rear End of the Boiler.

without bulging, as are ribbed, heavy cast-iron or hemispherical wrought-iron heads, in plain cylindrical boilers without tubes; then the seam C B, Figs. 4 and 7, would be called on to sustain the entire load on the area of the rear head; and even this is but half what is put upon the seams E E, etc., per lineal unit of seam measurement—*not* per square inch.

An explosion occurred in the same inspection district in September, 1875, which tends to confirm the theory above offered, and shows the difference in destructive effect between a full supply of water (in the boiler at the time of the explosion) and little or none at all. The boiler was of precisely similar construction shown in Fig. 8, and at the time of the explosion contained no water at all. It was in communication with two adjoining boilers of the same system, by means of the steam pipe, and it was ruptured by dry steam while its bottom over the fire was

red hot. It will be seen that the rupture is similar to that supposed to be the initial rupture in this case, and had the boiler (Fig. 5) contained no water, the damage would have stopped, as it did, here.

The boiler, Fig. 8, did not leave its setting, and no lives were lost, but the fireman was driven to the wall of the boiler-room. It dropped on the bridge wall, the fire front, which supported the front end, having been thrown down by the first gush of steam.

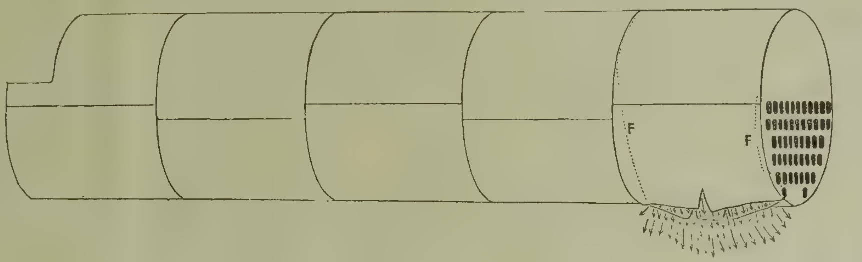


Fig. 5.

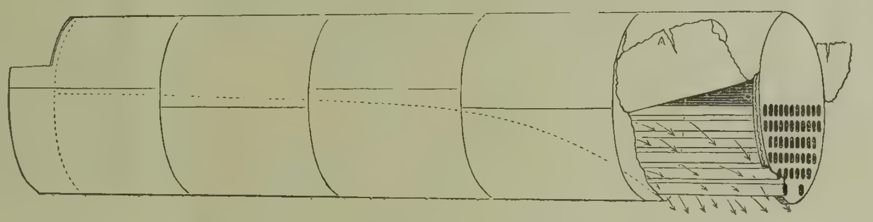


Fig. 6.

The Ericsson Torpedo.

Capt. Ericsson, who has been experimenting for a number of years in perfecting the torpedo for naval warfare, has at length produced what he considers a sufficiently effective engine of destruction. From the published accounts that have appeared we gather the following description:

After many experiments, Capt. Ericsson decided to use gunpowder instead of compressed air in the propulsion of submarine torpedoes carrying destructive charges of dynamite. His recent trials have been made with a projectile of peculiar form and a gun of novel construction. This trial gun is 30 feet in length and of 15 inches caliber, muzzle-loader, suspended under the bottoms of two wrecking scows, the gun being lifted above the water after each shot, by shears and suitable tackle. The present projectile of the "Destroyer" (as Capt. Ericsson calls his perfected invention) is the result of the extended trials referred to; its length is 25 feet 6 inches, diameter 16 inches, and its weight 1,500 pounds, including 250 pounds of explosive materials. It is made principally of wood, and its shape somewhat resembles a cigar. The point, or dynamite section,

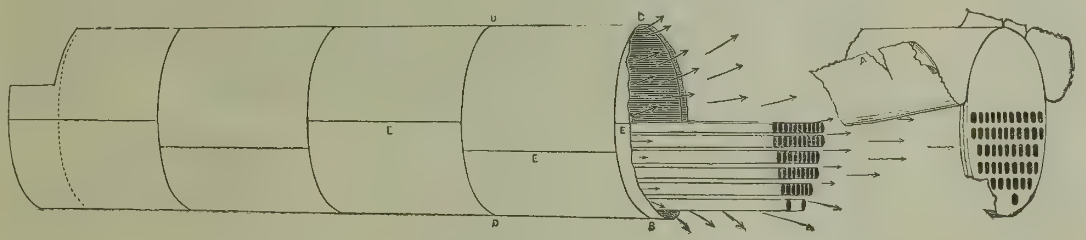


Fig. 7.

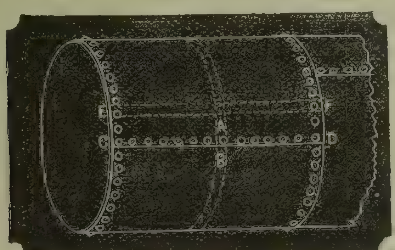


Fig. A.

about 5 feet in length from the vertex to the base, is made of copper, and a cast-iron armature is affixed to the tail to balance the weight of the opposite end. As it is made principally of wood, the "experimental" projectile, after it has run its course, will rise to the surface, and is readily recovered. For firing this projectile, Capt. Ericsson has applied to the "Destroyer" a gun similar to the one used in most of the experiments, but a breech-loader. It is a smooth-bore gun, 30 feet in length, of 16 inches bore, and is hooped with steel. The breech is locked upon the Dutch principle, and when unlocked is swung upward and over, with a hinge connection for the gun to receive the torpedo and the charge of gunpowder.

The results of the first experiments having proved satisfactory and successful, Capt. Ericsson has built at his own expense an iron vessel, which he has appropriately named the "Destroyer." This is now on the Hudson, where the experiments with the new torpedo have been carried on extensively for several months. These were concluded last November. Preparations are now making for a steam trial to determine the actual consumption of coal per mile, and to decide whether sufficient coal can be carried to take the vessel across the Atlantic. There is no armament to be seen, nor anything that gives the "Destroyer" the appearance of a war vessel to an ordinary observer, unless it may be her singular design. The form of the hull is very peculiar, the ends being precisely alike, and terminating with very fine wedges, probably sharper than any other vessels of deep draught yet built. The length is 130 feet, depth 11 feet, and beam 12 feet, thus presenting the unusual proportion of eleven times greater length than beam. The leading feature of the construction is that the vessel is provided with an intermediate curved deck extending from stem to stern, composed of plate-iron, strongly ribbed, and perfectly water-tight. This intermediate deck sustains a heavy, solid, deflecting armor-plate placed transversely to the line of the keel 32 feet from the bow, inclined at an angle of 45°, and supported on the aft side by a wood backing 4 feet 6 inches deep at the base. The steering wheel, and the electric batteries for discharging the torpedo gun, are placed behind this wood backing. A deck-house or cabin 70 feet long, composed of plate iron, is riveted water-tight to the upper part of the hull, and its forward end comes to the deflecting armor

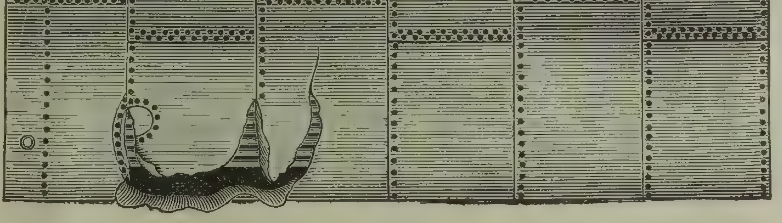


Fig. 8.

plate. This cabin is for the quarters of the officers and crew, and for the officer in command of the vessel, who has a view of everything ahead of him through a glass port. He steers the vessel and discharges the gun without fear of the enemy's guns, as he is protected by a wrought-iron armor plating in front of him, 16 inches in thickness. From the steering wheel runs a wire rope to a valve near the stern, by which water pressure is admitted alternately to the hydraulic cylinders at the stern, the motion of whose pistons turns the rudder. The rudder of this novel craft is another important feature, as it is wholly unconnected with the visible part of the stern, being attached to a vertical wrought-iron post welded to a prolongation of the keel just aft of the propeller, its upper part being about 5 feet below the water-line when the vessel is in motion at full speed. The tillers consist of thin plates of iron riveted on opposite sides of the rudder, a few inches from the bottom. These tillers are operated by straight rods, connected with the pistons of horizontal hydraulic cylinders, of 5 inches diameter, attached to the sides of the keel. Accordingly the steering gear will be placed 10 feet below water-line.

The gun, from which the torpedo is fired, is placed on the bottom of the forward part of the vessel, the muzzle terminating in the stem 7 feet below the water surface. Water is prevented from running into the gun by an outboard valve, opened and closed automatically. A small quantity of water rushes into the gun between the discharge of the torpedo and the closing of the valve, which is allowed to run into the bilge through the breech, and pumped out with a steam siphon. The projectile, with its charge of 250 pounds of dynamite, is first put into the gun, and in the space between the tail of the projectile and the breech of the gun, is put the charge of gunpowder.

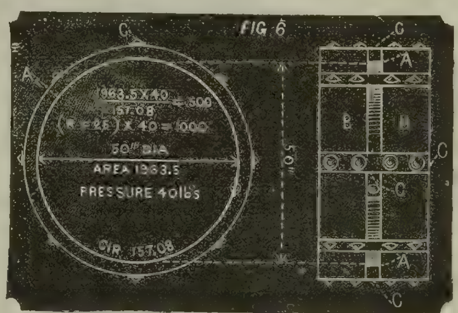


Fig. B.

The breech is then closed, and when the "Destroyer" is within 300 or 400 feet of the enemy's vessel, the gunpowder is ignited by electricity, and almost at the same instant the projectile has struck the hostile vessel below the water-line and destroyed her, the torpedo having been discharged by concussion alone. The initial velocity with which the projectile leaves the gun is 250 feet per second. With minimum charges of powder, in recent experiments, the projectile traversed the first 310 feet in three seconds. In all of the experiments which have been made, common cord nettings have been used to determine the curvature of the trajectory; but at a firing distance of 300 feet the course of the torpedo through the water has been absolutely straight. The projectile is exploded entirely by concussion, and is intended to strike a vessel

at any point under the water, and will pierce any netting that may be used for protection. It is supposed that a vessel like the great British iron-clad "Inflexible," even with a hundred water-tight compartments, could be sunk by the explosion of a single projectile. The tide currents have no serious effect on the course of the torpedo at its high speed, nor can its course under water be detected, as it makes no commotion after it leaves the gun.

The machinery of the vessel is entirely below the water-line, and is under the intermediate deck, so that it cannot be disabled by the shots of the enemy. It is simple and compact, and so arranged that two engineers and two firemen can take care of it. The boiler and engine rooms are connected, and the fires, the quantity and condition of the water in the boilers, the pressure of steam and the working of the engines are under the immediate observation of the engineers. Two boilers are placed amidships, where there is the least motion. They have single furnaces and a large amount of heating surface. The main condenser of the two direct-acting engines forms the bed-plate, and the entire steam machinery is so compact that it occupies a space of less than 8 feet square. The steam cylinders are of 22 inches stroke and 24 inches diameter, and can be worked up to 1,000 horse-power. The ordinary number of revolutions is 125 per minute, giving an average speed of 16 knots an hour. The lower division of the vessel is supplied continuously with cold air by blowers drawing it in from above to furnish draft for the fires and fresh air for those on board.

When ready for action, the "Destroyer" is intended to be as deeply sunk in the water as are the monitors, the vessel being submerged nearly to the level of the main deck; but this deep immersion need not alarm the ship's company, as it sometimes did in the case of the monitors during the war, because the deck-house has no opening on the sides; therefore it virtually forms part of the hull, and it would be safe to run with the upper deck considerably below the water-line. Owing to the peculiarity of construction, the entire superstructure and the upper part of the smoke-pipe might be shot away, and still not disable the vessel; and, Capt. Ericsson says, it can live at sea in any weather. Being protected by heavy inclined transverse armor, the "Destroyer," attacking bows on, can defy heavy ordnance, and, apart from the swiftness of its projectile through the water, can outrun iron-clad ships and be certain of destroying them.

The most important advantage attending the substitution of gunpowder for compressed air, will be that of saving the time lost during the operation of charging. In action a loss of time might prove fatal, since the enemy's vessel, which might have escaped being struck, would have time to change its position or retreat. But gunpowder is a potential energy stored within a very small space, and procured without the expenditure of mechanical power.

The erection of proper fortifications, and the manufacture of guns of the modern type for the defence of New York harbor, would demand an expenditure of tens of millions of dollars and occupy a series of years. In the meantime, naval authorities say, the entire city might be destroyed by any second-rate naval power, as, for instance, Spain, whose ironclads the United States have no vessels capable of meeting. The monitors are comparatively worthless at the present day, because laminated armor was retained when they were repaired a few years ago. The plan of using sunken torpedoes is thought futile, because means now exist by which the enemy can destroy such torpedoes. Hence it is argued that aggressive vessels, capable of meeting and destroying the enemy's ironclads in the lower bay, are most requisite, and that these must be such as can be constructed hastily. The works of this city could turn out a fleet of vessels such as the "Destroyer" within ninety days, which, it is claimed, could destroy the entire ironclad navy of Great Britain. Earth batteries thrown up along the shores of the bay, mounted with the many smooth-bore guns now lying at the various forts and navy yards, might be very useful in destroying the torpedo launches which the enemy would probably bring.

Physics Without Apparatus.

Our Paris contemporary, *La Nature*, has lately published a series of very ingenious illustrations intended to show how many of the more important principles of natural philosophy can be experimentally shown without the aid of philosophical apparatus, by improvising the same from commonplace articles. Some of these illustrations are highly interesting, as will be seen from the accompanying engravings, which we take from one of the recent issues of the magazine in question.

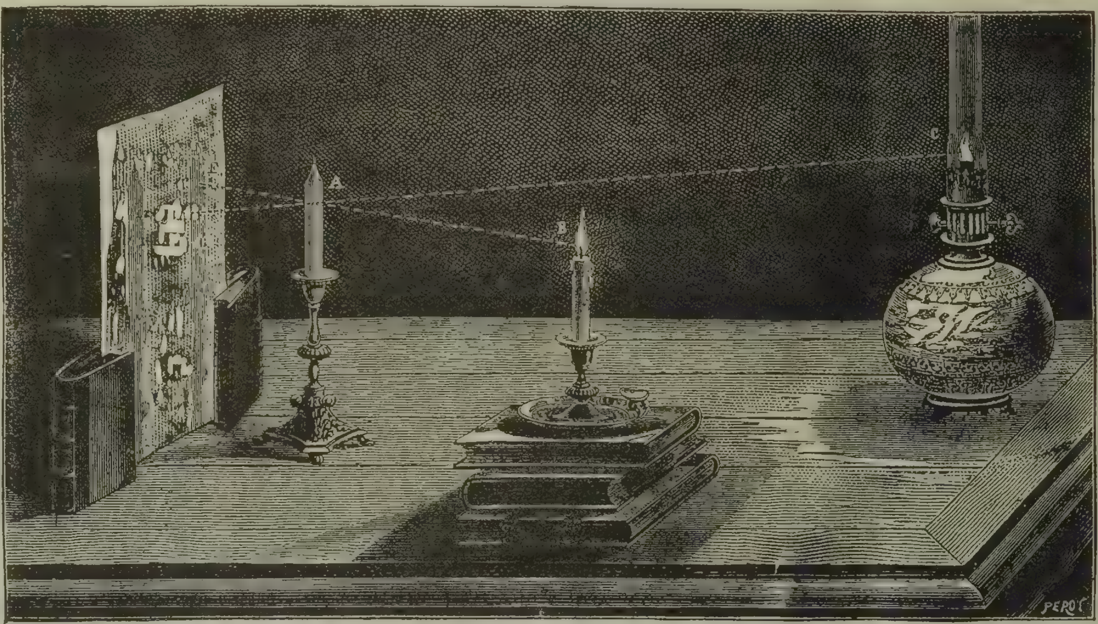


Fig. 1.—Photometer Improvised with a Candle and a Sheet of Paper.

In the department of optics, one of the most important branches of the subject is that of photometry, or the measurement of the intensity of light. In these days of gas-lighting and light-houses, the subject has attained a considerable practical importance, and the use of photometers, as the instruments are called, has become indispensable. The principle on which these instruments are based, is to compare the intensity of the light to be examined with that of some other source of light, taken as the unit of comparison. The standard adopted in all photometric work is the light emitted by a sperm candle, six to the pound, burning 120 grains to the hour; and the calculation of the result is based on the well-known law that the intensity of light at any distance from a luminous body is in an inverse proportion to the square of the distance. In the use of the photometer, the lights to be compared are so placed that they will illuminate a single surface, or two adjacent surfaces, with equal intensity (or, what is in effect the same thing, cast a shadow of equal intensity). The relative intensities of the two lights are then as the square of their distances from the illuminated or shadowed surfaces.

For illustrating this principle, our contemporary devises the following plan, shown in Fig. 1, as a substitute for the shadow photometer of Rumford. Take a sheet of white paper as a screen, and support it on a stand or table in a vertical position between the leaves of a couple of books. A short distance in front of this screen place a candle which shall cast the shadow; next locate the two lights whose intensities are to be compared, and which in this case are respectively an oil lamp and a candle. To get the shadows side by side for better comparison, the candle is shown elevated so that its light is at the same level as that of the lamp. Each light will then cast its shadow on the paper screen, and, by simply moving the one or the other until the two shadows appear equally intense, the experiment is finished. The calculation of the result is then proceeded with in accordance with the law above enunciated. This experiment must, of course, be performed in the dark.

The action of a convex lens our contemporary copies very successfully by the use of a carafe (or decanter) of glass, filled with water, shown in Fig. 2 on the opposite page. A candle is lighted in the dark, and by holding the improvised lens in the proper position between the candle-light and the wall (or a paper screen), the reversed image of the candle will appear upon the screen.

The above may serve as examples of the manner in which elaborate philosophical apparatus may be replaced on a pinch by home-made contrivances.

Indigo.

This well-known vegetable dyestuff is derived from a great number of plants which belong to the same family as our beans and peas. They grow in tropical countries, and are found native in Asia, Africa and America. There are in all about two hundred species of these plants, of which only a portion furnish the indigo of commerce. The species cultivated in India, when full grown, is a shrub from two to five feet in hight, with leaves and flowers somewhat like our sweet pea. The seed is sown in drills about a foot apart, during the rainy season, and the young plants are kept free from weeds for a few months, when they are ready for cutting. They are not allowed to come into bloom, as this would injure the quality of the dye. They are, therefore, cut just before flowering and tied up in large bundles, and at once taken to the factory. If kept even for a short time in these bundles, a sort of fermentation takes place which destroys the indigo. As soon as the plants reach the factory, they are thrown into a vat and strongly pressed down by means of a crossbar and lever; the vat is then filled with water and the mass is allowed to steep for ten or twelve hours, according to the state of the weather and the skill of the planter. This steeping process must be carefully watched, as, if continued too long, the indigo will be damaged or "burnt," and if not continued long enough the whole of the indigo will not be extracted. At the proper time the liquor is drawn off into another vat, where it is beaten and stirred with poles until granulation takes place, which occurs in from one-half to three hours. When the grains are properly formed, a few pailfuls of cold water or lime water are added to hasten the deposit. The lime water is said to injure the quality, as it precipitates foreign matter along

with the indigo. After the deposit has settled the water is drawn off, and this deposit is removed to a copper boiler, where it is retained until it begins to ferment. It is then placed on a cloth-covered frame and allowed to remain until the water is drained off. The residue is then placed in proper frames and strongly pressed; it is next removed and cut into cakes of a proper size, which are removed to the drying-house. After drying, in some districts the indigo is sent to market in this form; but in the interior of Bengal it is loosely packed in boxes with hemp between the layers. It here undergoes a sort of sweating, and is then removed to the drying-house, and when thoroughly dry is repacked and sent to market. Another method of procuring the indigo is by gathering the leaves and drying them in the sun; after enough have been accumulated, they are put in the vat and treated as above described.

Asiatic indigo is brought from several parts of India, and from Java and Manila. The best Bengal indigo shipped from Calcutta is the superfine or light blue, in cubical cakes, so light as to float on water, friable, soft, of clean fracture, and of a beautiful copper color when rubbed with the nail. Of the Bengal and Java there are many varieties in the market, and the amount of indigo blue present in these varies from forty to eighty per cent. Other kinds have from 10 to 37 per cent. Indigo is insoluble in water, but is easily dissolved by sulphuric acid without injuring its coloring qualities; it is then freely soluble in water, and may thus be used for purposes of dyeing. Saxon blue is simply a solution of this in water, and is used for laundry purposes. The best quality of indigo will float upon water, and when rubbed with the finger-nail will give a glossy and purplish red streak; when the streak is dull and furrows on each side, the quality is poor. Indigo is replaced in dyeing operations by the aniline colors, of which a large amount is now used. The increase of these or other dyes in Europe has been greater than in this country, as the indigo consumed here has increased to quite an extent since 1875. As the crop is about the same each year, the conclusion must be that less has been used in Europe. The total importations of all kinds of indigo into the United States during the fiscal year ending June 30, 1880, were 2,625,240 pounds, against 1,611,812 pounds for the previous year; 1,831,494 pounds in 1878, 1,504,783 in 1877, 999,139 in 1876, and 885,752 in 1875.

Copper.

Probably there is no metal capable of producing so many distinct alloys as copper. These different alloys are distinguished as much by their characteristics as by their color. And in the latter case the color may be made to vary from the red of the original copper to the almost blank white of silver. Take the composition of the widely known Babbitt's metal, employed throughout the world as bearings for journals, and in other places where friction occurs. It is nearly pure white, and yet out of 100 parts of tin, antimony and copper, the copper makes one-25th, the exact proportions being, tin, 8.9; antimony, 7.3; copper, 3.7. And there are bronzes used in the arts which have so slight an admixture of lighter colored metals with the copper as scarcely to change the color of the original and basic metal. Then the uses, the qualities and the purposes of these varying compounds are not equaled by those of any other of the baser metals. In iron the compounds are so slight that it is a puzzle, as yet not entirely solved, to discover and produce the exact change from fibrous wrought iron to crystallized high steel. There are mediums between these two extremes, but these are the extremes, and to produce these from the original metal, and to produce any of the grades between, requires a nicety of manipulation and a knowledge of chemistry and metallurgy that it takes years of application and patience to compass.

It seems as though a promising field is before the metal worker in the working of copper and its compounds. The number of metals with which copper will form useful alloys is so great, and the variations in the character of the alloys are so many, that there can be little doubt that there are resources in copper in its use in the arts which have not yet been exhausted.

Tempering in Sand and Tempering Chisels.

Joshua Rose contributes the following practical suggestions to the *Blacksmith and Wheelwright:* Color tempering in heated sand is a particularly faulty process. It is impracticable to keep the upper surface of sand heated equally with the bottom sand; indeed, it is almost impracticable to heat the upper surface to redness in the open air, the looseness of the sand permitting the heat to pass off too freely. If sand, heated to redness below, is disturbed, that which comes to the surface loses its redness almost instantaneously; as a result, the part of the steel imbedded in the sand heats too much in advance of the exposed surface, hence projecting parts, such as screw-threads, temper too quickly. If the steel is turned over in the sand, the fine particles of the latter obscure the temper colors, and it is doubtful if the best results can be obtained by the use of sand, no matter how slowly it is heated or how slowly the tempering proceeds.

Heated pieces of flat iron are excellent for flat rectangular pieces of steel. The iron should not be too thick in proportion to the size of the article to be tempered, and should be revolved while lying on the iron, as well as being turned over and over. This is necessary in case the iron should be unevenly heated. The article should be tempered slowly, resting on the side, faces and edges alternately, so that the heat may approach the center of the steel from all sides, which will induce uniformity. The piece should be removed for a few seconds, occasionally, from the iron, which will give the heat time to penetrate it and retard the heating of exposed edges or projections of small section.

When an article requires tempering in one part only, it is the usual practice to dip it in that part only, leaving the heat remaining in the rest of the steel to draw the temper of the hardened part, and an excellent example of this process is the common chipping chisel or a mill pick. Chipping chisels require to be tempered to the shade of blue that immediately succeeds the purple tints. The taper of a chisel is usually of such a degree that by the time the cutting end has had about five-16ths of an inch removed by the re-sharpening, that end will be too thick and must be drawn out, as the re-forging is termed, and the object in the hardening will be to have the temper equal in degree throughout this five-16ths of an inch, and to have the temper back of that run out gradually, and not suddenly, to normal softness, so as to avoid the breakage that will inevitably ensue if any part of the taper end of the chisel is left harder than a blue, or if the part tempered terminates suddenly.

In heating the chisel it should be frequently turned over and over in the fire, and must be occasionally withdrawn from the fire, so as to see that the thin end does not get overheated (which it is, from its thinness, very apt to do) before the thicker part is sufficiently heated. If the thin end is found to be heating too quickly, it may be pushed through the fire into the cooler coals, or dipped slightly at the point; but this latter plan is always to be avoided as much as possible. The blood-red heat should extend for about half an inch up the chisel, and the end should be dipped about seven-16ths of an inch in the water and held still for about eight seconds. It should then be dipped suddenly another three-8ths of an inch in the water and quickly withdrawn. The object of this second and deeper immersion is to graduate the temperature of the steel so that the colors shall appear in a broad band and very slowly, so that when the blue appears it will extend over about half an inch from the chisel end backward. The colors appearing and changing slowly will afford the eye ample time to determine when the exact proper shade of color has arrived, when the chisel may be dipped and withdrawn several times, so as to cool it and leave it tougher than it would be if cooled right off after being tempered to color.

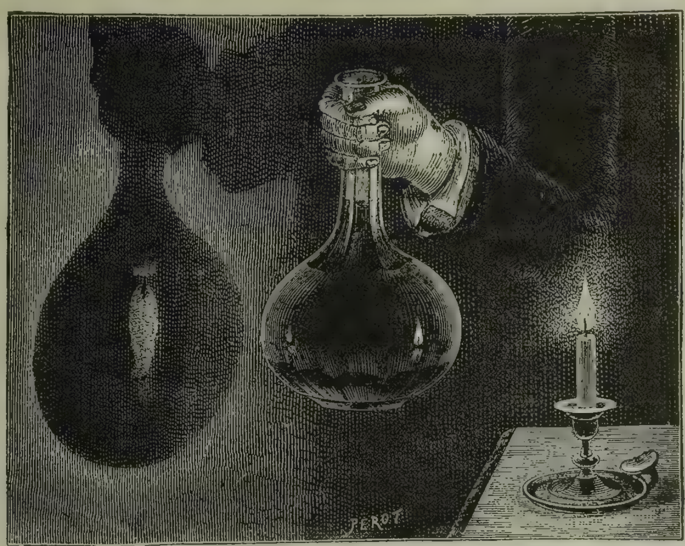


Fig. 2.—A Carafe of Water Used as a Convex Lens.

Applications of Coal Gas.

A special exhibition of considerable interest has just been held in Glasgow, Scotland, under the auspices of the Philosophical Society of that city, which was designed to illustrate the varied uses to which coal gas could be applied. The result is reported to have been a very interesting and successful display, which illustrated with a completeness not hitherto attained the uses of coal gas as an illuminating and heating agent, and as a motive power. The exhibition likewise afforded a good opportunity of comparing the most approved methods of illuminating by gas with the electric light.

It is to be regretted that so little interest is felt in this country in the extension of the uses of coal gas outside of its use as an illuminant. For this indifference the gas companies are doubtless largely to blame, since by offering the inducement of lower prices for gas used for heating purposes in gas stoves, or for running gas engines, the consumption of this agent would be very largely increased, with corresponding benefits to their treasuries. In this direction our home companies do not display the enterprise and sagacity of their European brethren.

How Icebergs are Formed.

Lieutenant Schwatka, of the U. S. Navy, the commander of an expedition sent in search of the relics of Sir John Franklin, read a paper at a late meeting of the National Academy of Sciences on "Observations on Ice and Icebergs in the Polar Regions." Two theories are held concerning the formation of the icebergs. One is that they are the result of the wearing action of water undermining the edges of glaciers, until at some point where the least resistance exists, they become detached. On the other hand, it is contended that they are of purely marine origin. Lieutenant Schwatka found that both of these theories were correct, and that in many cases icebergs were the result of the combined action of both methods. The hight of icebergs is a subject on which most observers differ

materially. This is attributed to the fact that the summit of the berg is apt to be obscured by a hazy mist which surrounds it. This phenomenon has the effect of deceiving the eye with regard to the proportions of the inclosed mass.

Scientific.

Progress in Electric Lighting.—Our readers are doubtless aware of the fact that Mr. Edison found it impossible, in his carbon-in-vacuo lamp, to make his carbonized paper horseshoes sufficiently durable when heated to a high degree of intensity to meet the requirements of practice. He met with better success by substituting a variety of bamboo, which yielded him a much more tenacious thread of carbon. With this, we are informed, he is enabled to run 9 lamps of 16-candle power each per horse-power, representing about 155 candles per horse-power. This is said to be a decided improvement in efficiency over his earlier horseshoe lamps, and as these bamboo threads are claimed to have a durability of six months of continuous service, it is evident that Mr. Edison is making decided progress towards the practical solution of the difficult problem of electric lighting for domestic uses.

In this connection, we cannot pass over the work that has been and is being done in this field by Mr. H. S. Maxim. This gentleman, recognizing the fact of the disintegration of the carbon strip in this carbon-in-vacuo lamp, and the difficulty, if not the actual impossibility of finding a substance that should give a perfect or indestructible lamp carbon, has struck upon the happy thought of providing a means of building up or reconstructing the carbonized filament as rapidly as it is wasted. With this object in view, he takes the carbonized paper strip, and, instead of sealing it up in vacuo as Mr. Edison has done, he encloses it within a glass globe filled with the vapor of gasoline—a hydrocarbon. The effect of this artifice is that the durability of the strip is greatly prolonged, for it speedily becomes plated, as it were, with a coating of graphitic carbon, resulting from the decomposition of the hydrocarbon vapor by its contact with the highly heated filament; and should there be any defective parts in the filament, these, by becoming more intensely heated than others, receive a heavier deposit. As this form of carbon is by far the best to resist injury from heat or mechanical causes, it seems probable that the durability of these graphitic coated strips should be very materially improved; and this feature is decidedly contributed to by the fact that any irregularities and defects that may have existed in them are repaired. These lamps give about 130 candles per horse-power, though recent trials, it is said, have shown much better results.

It is apparent from the above that our inventors are making slow but steady progress in the application of electric light for general domestic uses, though the problem is still far from being solved.

The Alimacantar.—Prof. S. C. Chandler, Jr., of Boston, who has of late invented several useful astronomical instruments, has just devised another for determining time and latitude, which he names the Alimacantar. It is thus described in the *Science Observer:* The instrument consists of a heavy base, with approximate leveling screws at the corners, from the center of which arises an upright cylindrical pillar surmounted by a cap of hard brass, and encircled at the middle and base by brass collars. These serve as the bearings for a hollow brass sleeve, fitting closely to the pillar and turning smoothly upon it. This sleeve is provided with a cross-head, and lateral diagonal braces which support a shallow trough in the form of a hollow rectangle. In this trough is contained mercury, to the depth of about one-eighth of an inch, upon which swims a float of wood or iron, also in the form of a hollow rectangle, a little smaller than the trough. By means of two pins, projecting from the sides of the trough and playing in vertical slots in the sides of the float, the latter is kept in place, while it is free to seek its equilibrium. From the middle of the inside edges of the float project two bent arms of brass, the lower ends of which support the horizontal axis of the telescope. The axis is provided at one end with a clamp, and at the other with an illuminating contrivance, and the telescope has a reticule of five horizontal spider-lines.

If the telescope is turned on its axis and clamped at any desired altitude, and the whole instrument revolved around the upright axis, the sight-line will describe a small circle in the heavens, parallel to the horizon. It is evident that the transit of stars, as they rise or fall over this horizontal circle, may be observed, and will furnish the means of finding the clock error, and also the latitude by a proper selection of the stars in different azimuths. If two stars be selected which pass over any horizontal small circle, within a few minutes of each other, on opposite sides of the meridian, the observation of their passage will give the data for determining the altitude of the instrument and the clock correction. Since the refraction equally affects the altitudes of both stars, it will eliminate itself from the clock correction.

Photographs in Natural Colors.—The announcement is again made that a process has been discovered for taking photographs possessing all the brilliancy and delicacy of the natural colors, and an exhibition of pictures thus naturally colored has just been held in London. According to the reports, the colors are produced by the action of light alone in the camera, and owe nothing whatever to the artist's brush. In the photographs exhibited, the coloring appeared to be quite true to nature, and delicate tones and shades were clear to the view. The flesh tint was exact to life, and full justice was done to gorgeous regimentals. The protruded tongue of a dog in one of the photographs possessed the exact color of nature. Some of the guests, says the *English Mechanic*, inspecting this collection, and not fully acquainted with the character of the latest invention, took it for granted that the work was done by skillful, artistic hands on ivory and other material, and could scarcely believe their eyes when informed that the color, as much as the form and outline, was produced by the light of day. Careful and minute investigation, however, would then show that human handicraft was not in it; for there were touches and effects which nature's pencil of light could alone accomplish. The contention is that photographs colored by artists, however clever, must be more or less "monotonous, hard, untrue to nature, and to the originals."

The process was discovered, it is said, by a French scientist, but has since undergone improvement by the proprietor of the process in England. If the new system proves an unqualified success, the reward will not have been reaped without much labor in the past, for numerous attempts have been made to induce the sun-pencil to fix colors in the pictures it draws in the camera; but chemical and mechanical difficulties have stood in the way. In the new process colors are said not only to be faithfully produced, but protected from the action of light by being passed through a boiling solution, of which gelatine forms the principal ingredient, and that some of the photographs so treated have been exposed for months to the sun without being, in any wise, affected by the ordeal. Unfortunately the process is as yet unknown, as it is likely to be for some time to come.

Signs of Death.—Dr. William Fraser, in a very interesting paper on "Real and Apparent Death," gives a number of indications by which one may distinguish between suspended animation and actual death. Of these, he asserts that the circulatory test, or the attempt to excite an actively congested state of the cutaneous capillaries, is preëminently the best, as it requires only simple and easily procurable appliances, which always yield decisive results either in the living or dead subject.

The application of heat and the act of cupping are both effective topical means for perceptibly arousing this preternatural activity of the cutaneous circulation, even in the most languid condition of the system compatible with vitality. He asserts that the entire absence of such distinctive physiological reactions, and the recurrence of merely physical alterations, under the proper use of these respective measures, is undeniable proof of death. Over the heart, he adds, is the most suitable region whereon to operate, as there the skin longest retains its vital warmth, but corroborative experiments may be performed over other parts of the trunk. His rules of procedure are as follows: Hold the flame of a candle close to (*but not in contact with*) the skin sufficiently long to render the cuticle easily detachable from its subjacent connections. If the body is dead, the parts beneath will present a crisp, yellowish-white horny appearance, unaffected by pressure; if alive, there will be readily perceptible a vital redness, distinguishable from all *post mortem* discolorations by its repeated displacement and reappearance under alternating pressure by the tip of the finger or otherwise. Exposing the part to bright light, and examining it through a magnifying glass, will render the different phenomena more evident. Again, kindle a piece of paper soaked in any alcoholic liquor, place it in an ordinary drinking-glass or goblet, and invert this over a part of the cutaneous surface where all its edge will come in accurate contact with the skin. If there remains a minimum degree of vitality, a state of superficial capillary congestion will be induced, with its unmistakably recurrent characters; whereas the absolute inability to excite such vital reaction in any part of the trunk's surface, and the production of solely physical effects by such potent agencies, are infallible evidence that all vital correlations are irreparably destroyed.

Polar Research.—*Nature* strongly urges upon England the adoption of Captain Howgate's plan of establishing stations in all future Arctic research. The so-called traditions of the English navy, it says, must be made to conform to the requirements of modern science if England is to do any useful work in Polar discovery. To squander $150,000 in one huge attempt to reach the Pole, would be as mad as for a merchant to embark all his capital in one hazardous undertaking. Polar research and Polar expeditions are not incompatible, but the former must be subordinated to and guided by the results of the latter. Preparations are being made by nearly all the countries of Europe, and by America, for a regular Arctic siege, to begin in 1882. The days of Arctic campaigns are past. We have reached the precincts of the citadel itself, and now the sappers and miners must begin their slow but sure work, to be capped at the proper time by a grand assault. Germany, Austria, Norway, Sweden, Russia, Denmark, the United States, and Canada are all to take part in this great work by establishing observing stations at suitable points all round the Polar area; while Italy is to send out next year a scientifically equipped expedition to the Antarctic region, our knowledge of which is meager and uncertain. This last will really be an observing as well as an exploring expedition, preparatory to the establishment of an Antarctic station.

The Influence of Sanitary Improvements in lessening the death rate is very strikingly shown in several official reports that have lately been published in Great Britain. One of these reports, relating to the city of Glasgow, shows that under the operation of certain important sanitary measures instituted and carried out under the direction of a Sanitary Commission, the average death rate per 1,000 inhabitants had been reduced nearly 11 per cent in the brief space of twelve years. The measures taken by this commission included, amongst others, the demolition of a number of unwholesome dwellings and the improvement of their surroundings, the making provision for ample hospital space for small-pox and fever cases, and the taking of rational measures for the control of epidemic diseases. The report of the Registrar-General shows likewise a considerable decrease in the death rate of a

number of cities and towns throughout the kingdom, by reason of improvements in their sanitary condition. The improvement is specially noticed in connection with the cities of Edinburgh, Aberdeen and Dundee.

In England, the sanitary officer of Manchester, in a report to the bishop of the diocese [why the bishop, of all persons in the world, deponent sayeth not.—*Ed.*] stated that "under the operation of the measures which have been adopted in that city, typhus and typhoid fevers, though not absolutely extinguished, are of comparatively rare occurrence, and nearly all other infectious diseases have been largely reduced in amount, while the general health has been improved."

The fact that in conservative England a sanitary officer should have the temerity to intimate to a bishop that typhus and typhoid fevers and other infectious diseases are amenable to sanitary regulations, and therefore are no longer to be classed in the category of providential dispensations, is an indication that sanitary science is indeed making progress.

Artificial Spinel and Corundum.—M. Stanislaus Meunier, a French savant, is reported to have succeeded in producing artificial spinel, identical in hardness and chemical composition to the natural mineral, by heating together in a porcelain tube chloride of aluminum, metallic magnesium, and the vapor of water. By the interaction of water vapor and aluminum chloride, he affirms, that he has also succeeded in producing artificial corundum.

The Proper Form of Lightning Conductors.

Mr. William Henry Preece, a well-known English electrician, read before a late meeting of the British Association a paper with this title, in which he has effectively disposed of the theory which has always been a favorite one with some scientific men—that the form of a lightning-rod has a decided influence on its electrical conductive capacity. The advocates of this view have maintained that electricity of high tension passes at the surface, while galvanic electricity passes through the mass of a conductor; hence, they argued, the greater the surface we give to a lightning-rod the better will be the path afforded the lightning, and the more effective the rod.

Mr. Preece has shown experimentally that this view is erroneous, and that the discharge of electricity of high tension follows the law of Ohm; and that therefore the efficacy of lightning conductors of the same material depends upon their masses and sectional areas, and is quite independent of the extent of surface they expose. This view of the subject has long been held by the great majority of electricians, but the manufacturers of lightning-rods still continue the practice of making expensive spirals, ribbons and tubes, on the assumption that the more surface they give the better, and that a light rod of these forms is more efficacious than a plain cylindrical rod of the same material and of greater weight. This notion must be regarded as having been completely exploded, and the only things to be regarded in the selection of a rod are its material and its sectional area, and of course its proper erection.

We esteem Mr. Preece's paper to be particularly useful, in that it corrects an error that is widely spread among intelligent people. For this reason we here publish his paper in full:

A lightning conductor erected for the protection of a building, consists of a ribbon, rod, chain, rope or other mass of metal attached to the highest point of the structure, and descending to the earth. What shall be the form of this conductor has been a vexed question from the days of Franklin to the present. Shall it be dependent on extent of surface or on sectional area? In other words, does the transference of electricity, when the potentials are so high as to cause lightning discharges, obey the law of Ohm? or is this law modified by the presence of some fresh condition? Snow Harris was a very warm advocate of the surface form. He used flat ribbons for his ships, and tubes for his buildings. Henry, of Washington, believed in the efficacy of surface. According to him, frictional electricity passes at the surface, galvanic electricity through the mass. M. Melsens is found on the same side, and Guillemin, of Paris, led many French electricians to favor the same view.

On the other hand, Faraday almost angrily espoused the opposite side. "As respects electrical conduction," said he, "no advantage is gained by expanding the rod horizontally into a strap or tube. Surface does nothing; the solid section is the essential element." The advocates of the solid and cylindrical form argue that the lightning conductor is simply a path by which electricity is transferred from a point of high potential (an electrified cloud) to a point of lower potential (the earth), and that its efficacy depends solely upon its resistance. It obeys the law of Ohm, and its efficacy is therefore for the same material dependent on its mass and sectional area.

The advocates of surface argue, that, as in all cases of static charge, electricity exists only on the surface, so when electricity of "high tension" is conducted away, it is the surface that plays the prime part, and therefore the greater the surface the easier the path to the discharge. Again, they say when a cylindrical conductor conveys a charge of electricity, it is raised to a "high tension," and is rendered capable of doing mischief; but with the same charge, the greater the surface the less the density on the surface, and therefore the greater the safety. In other words, with a given quantity of electricity, the greater the surface the less the potential. Moreover, they urge, since, according to Guillemin, currents of electricity flowing in the same direction retard each other with a power varying with the distance separating them, and since a rod may be considered as a bundle of smaller but parallel rods, so a current of electricity may be considered as being made up of many parallel currents, each retarding the other. Hence a ribbon will conduct better than a rod, because the currents are spread further apart, and retard each other less. These arguments have led to the employment of unsightly ribbons and expensive tubes, which have considerably interfered with the establishment of this very necessary element of safety to buildings.

The arguments in favor of the surface form, are, in the opinion of the author, deductions from exploded theories, from imperfect experiments, or from erroneous interpretations of well-ascertained facts. No direct experiments have ever been made to solve the question, as far as the author knows. Quantities of electricity—that is, static discharges from condensers, are in incessant use for telegraphic purposes, and are found to follow exactly Ohm's law, even with the most delicate apparatus. The knowledge of the flow of electricity through conductors, of the retarding influence of electro-static capacity upon this flow, and of the distribution of charge, has become so much greater of late years through the great extension of submarine telegraphy and the labors of Sir William Thomson, Clerk-Maxwell and others, that I question if any English electrician would now be found to argue in favor of the surface form. Nevertheless, ribbons and tubes continue to be used, and it appeared very desirable to settle the question experimentally. I determined to try and do so.

First Experiments, June 28, 1880.—Dr. Warren de la Rue, who is always ready to place his splendidly equipped laboratory at the service of science, not only allowed me to use his enormous battery and his various appliances, but aided me by his advice and assisted me in conducting the experiments.

Copper conductors, 30 feet long, of precisely the same mass (*a*), drawn into a solid cylinder (*b*), made into a thin tube, and (*c*) rolled into a thin ribbon, were first of all obtained. The source of electricity was 3,240 chloride of silver cells. The charge was accumulated in a condenser of a capacity of 42.8 microfarads. It was discharged through platinum wire of .0125 diameter, of different lengths. The sudden discharge of such a large quantity of electricity as that contained by 42.8 mf. raised to a potential of 3,317 (the electro-motive force of the chloride of the silver cell being 1.03 volt) volts is very difficult to measure—it partakes very much of the character of lightning. In fact, the difference of potential per unit length of air is probably greater than that of ordinary lightning itself. It completely deflagrates 2½ inches of the platinum wire; but by increasing the length of the wire, it could be made to reproduce all the different phases of heat which are indicated by the various shades of red until we reach white heat, fusion, and deflagration. Hence the character of the deflagration, which is faithfully recorded on a white card, to which the wire is attached, by its scattered particles, is a fairly approximate measure of the charge that has passed, while the length of wire, raised to a dull red heat, is a better one, for any variation in the strength of the current within moderate limits is faithfully recorded by the change of color.

Experiment 1.—Similar charges were passed through the ribbon, tube and wire, and in each case 2½ inches of wire were deflagrated. No difference whatever could be detected in the character of the deflagration.

Experiment 2.—Ten inches of wire were taken and similar charges passed through. In each case the wire was raised to very bright redness, bordering on the fusion point, and in two cases the wire broke. In each case the wire knuckled up into wrinkles, and gave evidence of powerful mechanical disturbance. The same wire was not used a second time. No difference could be detected in the effect through the different conductors.

Experiment 3.—Silver wire of the same diameter and length was used, and similar charges transmitted through it. Redness was barely visible, but the behavior of the wire was similar in each case.

The conclusion arrived at unhesitatingly was that change of form produced no difference whatever in the character of the discharge, and that it depended simply on mass.

Second Experiments, July 19, 1880.—As it might be urged that the length of conductor tested was so short, and its resistance so small, that considerable variations might occur and yet be invisible, similar lengths (30 feet) of lead—a very bad conductor, its resistance being twelve times that of copper—were obtained, drawn as a wire, made as a tube, and rolled as a ribbon, each being of similar weight.

Experiment 4.—Charges from the same condenser, 42.8 mf., but with 3,280 cells, were passed through, and the discharges observed on 6 inches of platinum wire 0.0125 of an inch in diameter, which in each case was heated to bright redness. No variation whatever could be detected, whether the wire, the tube or the ribbon were used.

Experiment 5.—In order to form some idea as to how closely we could estimate any variation in the character of the discharge, we used a long piece of platinum wire, and adjusted the lengths until we obtained just visible redness; then a diminution of 10 per cent (3 feet) produced a marked change to dull redness, and further excisions raised the temperature to brighter and still brighter red.

The conclusion arrived at was that any change in resistance of 5 per cent would have been clearly and easily discernible.

It therefore appears proved that the discharges of electricity of high potentials obey the law of Ohm, and are not affected by change of form. Hence, extent of surface does not favor lightning discharges. No more efficient lightning conductor than a cylindrical rod or a wire rope can therefore be devised.

Rice Cement.—Mix powdered rice with a little cold water and then gradually add boiling water until a proper consistency is acquired, being careful to keep it well stirred all the time; lastly, it must be boiled for one minute in a clean saucepan. This adhesive is beautifully white and almost transparent, for which reason it is well adapted for fancy paper work, which requires a strong and colorless cement.

Centigrade and Fahrenheit.

In the Fahrenheit thermometer used in America and Great Britain, the number 0° on the scale corresponds to the temperature of a mixture of salt and ice—the greatest degree of cold that could be artificially produced when the thermometer was originally introduced; 32° (freezing point) corresponds to the temperature of melting ice; and 212° to the temperature of pure boiling water—in both cases, under the ordinary atmospheric pressure of 14.7 pounds per square inch. Each division of the (this) thermometer represents 1° Fah., and between 32° and 212° there are 180° In the Cent. thermometer, used in France, and in a few other countries in Europe, and universally in scientific investigations, 1° corresponds to melting ice, and 100° to boiling water. From the freezing to the boiling point there are 100°.

The accompanying table shows the relation of the Centigrade and Fahrenheit thermometer scales, 5° C. being equal to 9° F., because the interval between the freezing and boiling points of water is divided into 100 and 180 equal parts, and these numbers are respectively multiples of, or 20 times 5 and 9. If the superfluous 32° on the F. side were disposed of, the mutual translation of the scales would be simple, since the two units are to each other inversely as the number of them in any given range.

To reduce F. above melting ice to terms of C., 32° must first be subtracted from the given F. temperature, then multiply the remainder by $^5/_9$; the product will be the C. term for the given temperature; and conversely divide C. by $^5/_9$ and add 32 to translate C. into F.; to prove the work, read the terms across the diagram in the table. Below melting ice, the same rules as given above apply, except that where 32 is added above, it should be subtracted here, and *vice versa*.

In the columns at the right hand of each diagram in this table, are found the approximate steam pressures per square inch, due to the adjoining indications of temperature. The pressure is expressed in pounds and in atmospheres.

The high pressures are obtained from the several authors who have deducted and tabulated them from experiments and formulas of Regnault and others; and being hypothetical, accuracy is not claimed for them.

COMPARISON OF CENTIGRADE AND FAHRENHEIT SCALES, AND APPROXIMATE STEAM PRESSURE IN POUNDS AND ATMOSPHERES PER SQUARE INCH DUE TO THE TEMPERATURE.

Thermometer. Centi.	Thermometer. Fahr.	Steam. Non-condensing Engine. Pres. per gauge. lbs.	Total Press. Lbs.	Total Press. Atmos.	Thermometer. Centi.	Thermometer. Fahr.	Steam. Condensing Engine. Press. per gauge.		Back Press. Lbs.	Back Press. Atmos.
260	500	665	680	46.	100	212	0		14.7	1.
255	491	610	625	42.	95	203	Vacuum, effective. Gauge.	Lbs.*	12.	0.85
250	482	560	575	39.	90	194	9½	4.7	10.	0.7
245	473	515	530	36.	85	185	12½	6.2	8.5	0.6
240	464	472	487	33.	80	176	15½	7.7	7.	0.5
235	455	430	445	30.	75	167	18¼	9.1	5.6	0.4
230	446	390	405	27.5	70	158	20½	10.2	4.5	0.3
225	437	354	369	25.	65	149	22	11.	3.7	
220	428	321	336	23.	60	140	24	11.9	2.8	0.2
215	419	290	305	20.7	55	131	25	12.4	2.3	
210	410	262	277	18.8	50	122	26	12.9	1.8	0.2
205	401	235	250	17.	45	113	26½	13.3	1.4	
200	392	211	226	15.3	40	104	27¾	13.6	1.1	0.1
195	383	188	203	13.8	35	95	28½	13.8	.9	
190	374	167	182	12.4	30	86	29	13.9	.8	
185	365	148	163	11.1	25	77				
180	356	131	146	9.9	20	68				
175	347	115	130	8.8	15	59				
170	338	100	115	7.8	10	50				
165	329	85	100	6.8	5	41				
160	320	73	88	6.	0	32				
155	311	63	78	5.3	— 5	23				
150	302	55	70	4.7	—10	14				
145	293	45	60	4.1	—15	5				
						0				
140	284	37	52	3.5	—20	— 4				
135	275	30	45	3.	—25	—13				
130	266	25	40	2.7	—30	—22				
125	257	19	34	2.3	—35	—31				
120	248	14	29	1.9	—40	—40				
115	239	10	25	1.6	—45	—49				
110	230	6	21	1.4						
105	221	3	18	1.2						

Temp. of Condenser. (212 to 86 F.)

* To be added to the pressure indicated by steam gauge to get total pressure on piston.

M. T. Mines of Brittany, 500 ft., . . . 59 F.
Hydr'chloric Ether boils, 52 F.
Max. density of water, { 39.2 F. = 4 C.
Melting Ice, . 32 F. = 0 C.
Blood freezes, . . 25 F.
Castor Oil freezes, . 21 F.
Spirits of turpentine freezes, . . 14 F.
Brandy freezes, . —7 F.
Mercury freezes, . —40 F.
Sulphuric Acid (1.641) freezes, . . —45 F.
Greatest artificial cold, . —166 to —220 F.
Absolute cold, . { —459.4 F. —273. C.

Production of Malleable Nickel.

The brittleness of metallic nickel has always been an obstacle in the way of manipulating it. This quality has long been suspected to be due to the fact that the metal in the course of its preparation absorbed oxygen to a greater or less degree. Acting upon this theory, which is *a priori* reasonable, from the fact that it is known to have been verified in the case of copper and certain other metals, numerous efforts have been made to incorporate with it, during fusion, certain metallic or other substances which should have the power of removing the oxygen while not impairing the good qualities of the product by its presence. With this object in view, the addition of small quantities of magnesium, and of manganese, to fused nickel, have been tried, and, in the case of the first named, with considerable success.

Guided by the remarkable success that has attended the addition of phosphorus to copper alloys, as is shown in the production of phosphor bronzes having extraordinary tensile strength, M. Garnier, who is largely interested in the production of nickel, has made some experiments on the addition of phosphorus to this metal, with the view of improving its malleability, which, as we are informed, have given unexpectedly good results. From the accounts of these experiments which have come to hand, it is affirmed that if phosphorous to the amount of 1 in 3,000 be added to nickel, the metal becomes soft and very malleable; the addition of a larger quantity of phosphorus develops the hardness of the metal at the expense of its meallea-bility.

The phosphorus is added to the metal in the form of a phosphide of nickel containing 6 per cent of phosphorus, which is made in turn by fusing together a mixture of calcium phosphate, silicic acid, carbon and metallic nickel.

The assertion is further made that the nickel produced by treatment with phosphorus, is not only malleable of itself, but that its alloys with copper, zinc or iron are likewise soft and malleable.

Our readers will perhaps recall, in connection with this article, a communication published in the Manufacturer and Builder some months ago, in which we described a new process for the refining of copper by the use of phosphor-copper. The results obtained in both these cases, as described, are perfectly analogous; and it would appear therefrom that we have, in the addition to brittle metals of phosphorized alloys, an infallible method of removing occluded gases or oxides, with the result of greatly improving their homogeneity and strength and working qualities.

A Standard Pressure for Boilers.

A committee composed of a number of the largest users and manufacturers of steam machinery in the city of Philadelphia, lately presented the following self-explanatory petition to the mayor of that city:

"We, the undersigned, manufacturers and steam users in the city of Philadelphia, recognizing that in the city ordinance regulating the inspection of steam boilers, there is no standard of pressure for boilers of different diameters and construction, petition your Honor to appoint a commission to consider the propriety of so amending the present ordinance, that some standard shall be designated which shall become the law for such pressure. There are two tables of pressure used. That adopted by the United States government is based upon experiments made with American iron and methods of construction. This table is used by the Board of Supervising Inspectors of Steam Vessels—marine and inland. The other table is that known as Fairbairn's, and is based upon experiments made by Sir William Fairbairn, of England. These experiments were made with English iron, and give lower pressures than are generally used in this country. It seems important to your petitioners that some standard which will not be so low as to interfere with our industries, nor so high as to be dangerous, should be established; and we respectfully request that you act promptly, so that the early attention of Councils may be directed to this matter, and that inspectors and engineers may have some law to guide them in calculating the safe working pressures of boilers in our city."

The Mayor, in accordance with the prayer of the above petitioners, appointed Messrs. Chas. T. Parry, Jacob Naylor, Coleman Sellers, Chas. H. Cramp and James Hunter as an Advisory Committee, to frame an ordinance to cover the subject, for the consideration of Councils. The action of this committee may have more than a local influence.

Freeing Benzine from Offensive Odor.—According to Mr. Fairthorne, benzine may be freed from all offensive odor by shaking it up well with quicklime—about three ounces to the gallon.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	25 a —
Spruce plank, 2-inch	38 a — 40
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	50 00 a — —
Oak	55 00 a 60 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a 100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 00 a — —
Yellow dressed pine flooring	30 00 a 37 50
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	4 50	a — —
Up Rivers	— —	a — —
Jersey	— —	a — —
Long Island	9 00	a 9 50
Haverstraw Bay	— —	a — —
" " choice	10 00	a — —
Favorite Brands	9 50	a — —
Hollow Fire-Clay Brick	12 50	a — —

FRONTS.

Croton—Brown, per M.	10 00 a 11 00
" Dark	11 00 a 12 00
" Red	11 00 a 12 00
Philadelphia	— — a — —
Trenton	21 00 a 22 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	24 50 a — —
" Glengarnock	23 50 a — —
" Eglinton	22 00 a — —
" American, No. 1	25 00 a 26 00
" American, No. 2	23 00 a — —
" American, forge	22 00 a 22 50

	Store prices. Cash.
Bar, Swedes, ordinary sizes	— 6 a — 6¼
Bar, Swedes, nail-rod	— 6½ a — —

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37½
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 50 a 5 75

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7¼ a — 7⅜
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	- 85 a - 90
do do No. 1, blue, in rough	- 75 a - 80
Bedford Stone	1 25 a - —
Berlin Freestone, in rough	- 85 a - —
Berea Freestone, in rough	- 75 a - —
Brown Stone, Portland, Conn	1 05 a 1 30
Bay of Fundy Wood Point Brown Stone	1 00 a - —
do Mary Point Brown Stone	1 00 a - —
do do Olive Stone	1 00 a - —
Brown Stone, Belleville, N. J	1 25 a 1 75
Granite, rough	- 75 a 1 00
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a - —

PAINTS.

*Carmine, American, per lb. gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags gold	— 55 a — 57 ½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8¼ a — 9
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 65 a 3 40
Portland (American)	2 25 a 2 50
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 65 a 3 80
Portland (German, Bonner)	2 85 a 3 25
Lime of Teil	2 20 a 2 30
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 15 a 1 25

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 00
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Nova Scotia, white, per ton	3 50 a 4 00
Nova Scotia, blue	3 50 a 3 75
Calcined, Eastern and city, per bbl	1 25 a — —
Calcined, city casting	1 50 a — —
Calcined, city superfine	1 75 a — —

LIME—PER BARREL.

State, common	— 85 a — 90
" finishing	1 15 a — —
Rockland, common, cargo rate	— 90 a — —
" finishing	1 00 a — —
Ground	— 95 a 1 00

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 28
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 25
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	25 00 a 50 00
Lignumvitæ, other sizes	10 00 a 20 00

CEDAR.

Cuba, per superficial foot	— 8 a — 11
Mexican, small	— 8 a — 9½
Mexican, large	— 10 a — 11
Florida	— 40 a — 75

LABOR.

Ordinary, per day	1 75 a 2 00
Masons, do	2 75 a 3 00
Plasterers, do	3 00 a — —
Carpenters, do	2 75 a 3 00
Plumbers, do	2 50 a 3 00
Painters, do	2 50 a — —
Stone-Setters, do	2 75 a 3 00

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)
Discount 50 to 60 per cent, according to quality and size of order.

Pipe, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

DOORS, WINDOWS, AND BLINDS.

Doors, Raised Panels, Two Sides.

2.0 x 6.0	1¼ inch.	$ 84	——
2.6 x 6.6	1¼	1 18	——
2.6 x 6.8	1¼	1 24	——
2.8 x 6.8	1¼	1 30	——

Doors, Molded.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 54	——	——
2.6 x 6.6	1 90	2 41	——
2.6 x 6.8	1 96	2 43	——
2.6 x 6.10	1 98	2 51	——
2.6 x 7.0	2 02	2 61	——
3.8 x 6.8	2 02	2 61	3 25
2.8 x 7.0	2 11	2 71	3 35
2.10 x 6.10	2 23	2 82	3 50
2.0 x 7.0	2 33	3 06	3 75

Outside Blinds.

Up to 2.10 wide, per lineal foot	25 a —
Up to 3.1 wide	27 a —
Up to 3.4 wide	30 a —

Inside Blinds.

Per lineal foot, 4 folds, pine	56 a — —
Per lineal foot, 4 folds. ash or chestnut	— 90 a — —
Per lineal foot, 4 folds, cherry or butternut	1 07 a — —
Per lineal foot, 4 folds, black walnut	1 30 a — —

Review of the Markets.—In the lumber market since our last report, consumption has been fair, but not so full as anticipated. The shipping movement has been checked, and this has prevented any great amount of buoyancy. Confidence, however, has been apparently in no way shaken among holders, and a hopeful feeling has generally prevailed.

In the brick market there has been an increased consumption and a diminished supply, with a considerable stiffening of values. The market has steadily favored the seller, with the tendency still upward. As matters stand at the present writing, it is almost useless to attempt giving any positive line of quotations, and our figures are therefore in most cases nominal.

In the lath market the general situation has been favorable to the selling interest. Stocks in the hands of dealers have been by no means liberal, and in some cases have been quite small, while consumption has been pretty good, and continues on the increase, with little prospect of an offset in the way of fresh arrivals of any magnitude for some time to come.

In the cement market there has been a good, fair, seasonable demand for both foreign and domestic brands.

In the lime market demand has been good, and everything offered has been placed, with full former rates obtained all around, the market ruling firm. A larger supply would no doubt have found an outlet, but no addition of importance can be looked for before spring.

In the hardware market the tendency has been toward an improving business, and some dealers have reported quite an animation. The call has come from seasonable quarters, and has covered about the usual assortment, with buyers moving cheerfully and apparently not afraid to invest to the full extent of their known wants. The severity of the winter has had an influence to check business considerably, owing to the difficulty and expense attending the movement of supplies.

In the paint market demand has not been very active, and as a whole the market has had a quiet tone throughout the month.

In the metal markets American pig has been selling with freedom, but prices have made no material improvement. Scotch pig has had a somewhat irregular market, but with reduced supplies and better accounts from abroad, the market has taken a more cheerful tone, and at this writing is firm. Manufactured iron has been quite active, though there has been no attempt to force a large advance. Domestic pig lead has found a very active demand, and on liberal sales prices rapidly advanced. Tin in pig has also been in good demand, and with stocks under control is now generally firm. Tin plates have met a fair call from regular sources, and have remained pretty steady on the average, with the tendency in sellers' favor.

Adulterations of Food.

Abstract of a paper read before the meeting of the American Social Science Association, at Saratoga, by Professor S. W. Johnson.

(*Continued from Page* 18, *January Number.*)

With syrups the case is doubtless otherwise. They are now made from Indian corn, consisting entirely of glucose—using that term in its commercial sense—and these are, or may be, employed for adulterating what we commonly regard as genuine syrups. These corn syrups are cheaper than those which come from the sugar cane. When skillfully made, they are not inferior in appearance, and though less sweet than cane syrups, they are perfectly palatable and equally nutritious and healthful. Glucose, like oleomargarine, is a perfectly legitimate object of production and an entirely wholesome article of food. Its artificial formation from the starch of corn, by the action of acids, in the Buffalo and Chicago manufactories, is quite in imitation of the natural process of digestion in the human stomach. In fact, all the starch of our food, it is believed, must be transformed into glucose before it can enter the blood and serve as nutriment. Corn syrups are now extensively made and consumed in our Western States. They are usually, I believe, and always may be, free from anything poisonous or hurtful to health. Cases are on record in which they have contained injurious metals, but these are probably the result of accident or carelessness, and are no more a necessary incident to the manufacture of glucose than to that of cane syrups.

I have once met the complaint that white sugar was mixed with a suspicious-looking blue substance in the form of powder. This was the harmless pigment known as ultramarine blue. The purest cane or beet sugar that can be obtained by the refining processes now used, has in itself a disagreeable yellowish tint. This tint is neutralized optically by adding to the sugar a very small, ordinarily quite unnoticeable proportion of ultramarine, which therefore greatly improves the whiteness and beauty of the sugar. This addition is, in the most strict sense, an adulteration; but evidently common sense, as well as long established usuage, relieve it from that odium, unless, as was true in the case complained of, the quantity added is excessive.

Within a year or so the public has had a scare as to the presence of *tin* in sugars and syrups. In fact, solutions of tin—the so-called muriate of tin—are employed by some sugar manufacturers in the process of refining, and a portion of the tin may remain in the sugar, and especially in the molasses. The quantity of tin thus remaining is in most cases excessively minute, and not likely to occasion injury to health.

Confectionary includes a class of articles that may be regarded as very liable to adulteration. Candies have been made and sold having all the colors and tints of the rainbow, and owing their colors to nearly all the mineral poisons that are known to the arts. Chromate of lead has been used to give sugar a yellow and an orange color, red lead and vermilion to produce red tints, Prussian blue and the vegetable poison indigo to make blues, while copper and arsenic have been used for producing greens. These poisons, and almost every kind of known pigment, appear to have been used formerly in England, especially in the decoration of sugar dogs, cats and other saccharine statuary, in the construction of which we might credit the workman with forgetting the utilitarian notions that would influence the mere candy-puller, as well as all the maxims of sanitation and toxicology, in the enthusiasm that art begets in its devotees, were it not for the fact that the more expressionless and amorphous the image, the more *terra alba,* pigment and poison, it is sure to carry. The employment of the deadlier poisons in making confectionery, has no doubt been oftener the result of ignorance than of intention, for evidently the most depraved candy-maker can have no object to kill his customers outright. Slow poisoning would seem fully to answer his purpose, for Dr. Endeman, Chemist to the New York Board of Health, in numerous examinations of the confectionery on sale in that city, found in them no compounds of copper, mercury or arsenic, although chromates of lead, lime and baryta were recognized in the yellow sorts, and Prussian blue, ultramarine, lampblack and various vegetable colors were commonly used; while to give weight, as cheap substitutes for sugar, gypsum, starch and white clay were employed. The obvious lesson of these facts is to avoid colored confectionery, and especially cheap confectionery. It might be added, avoid all confectionery; but that advice, like much other, is least heeded where most needed.

The adulteration of flesh-meats finds its field in sausages, potted or canned meats and meat pies. An English health officer of a town near Manchester, said, some twenty-five years ago: "We have in Newton five knackers' yards, and there is only one in Manchester. The reason is, they have so much toleration in Newton, and it has been a source of great profit to them, because they have the means of selling the best portions of the horse-flesh to the makers of potted meats. I can say for a fact, that the tongues of horses, and the best portions, such as the hind quarters of horses, are generally sold to mix with collared brawn, or pigs' heads, as they are called with us, and for sausages and polonies (Bolognas). I understand, also, from those who have been in the habit of making them, that horse-flesh materially assists in the making of sausages; it is a hard fibrine, and it mixes better and keeps them hard, and they last longer in the shop windows before they are sold, because otherwise the sausages run to water and become soft and pulpy."

Whether the current traditions as to the use of other domestic animals in sausages are correct, the writer cannot say, nor is it positively known whether the sausage-makers are at the real bottom of the evidently organized opposition to the enactment of satisfactory dog laws. It is just conceivable that legislation on this subject has been blocked hitherto simply because mutton is not fit for sausages until it has become dog! As to meat pasties in this country, there is no authentic information to be had; but the consumers of these delicacies in our great cities would do well to ponder on the significant words of Mr. Samuel Weller. "Weal pie," said Mr. Weller; "wery good thing is a weal pie when you know the lady as made it, and is quite sure it ain't kittens; and arter all, though, where's the odds, when they're so like weal that the wery piemen themselves don't know the difference? I lodged in the same house with a pieman once, sir, and a wery nice man he was—reg'lar clever chap, too—make pies out 'o anything, he could. 'What a number of cats you keep, Mr. Brooks,' says I, when I'd got intimate with him. 'Ah,' says he, 'I do—a good many,' says he. 'You must be wery fond 'o cats,' says I. 'Other people is,' says he, a winkin' at me. 'They (the pies) are all made of them noble animals,' says he, a pointin' to a wery nice little tabby kitten, 'and I seasons 'em for beefsteak, weal or kidney, 'cording to the demand.'" It is very possible that these remarks, originally calculated for a longitude near Greenwich, may apply to the meridians of New England or New York.

The articles most extensively adulterated are such as are employed, not so much for the nutriment they furnish, as for their appetizing or stimulating effects, which bring them into the class of luxuries. Everything of this kind, it would appear, is liable to falsification. Pickles, for example, properly consist of cucumbers, cauliflower, young beans or other vegetables preserved in pure vinegar of good strength, with no addition beyond salt, mustard or pepper. If you want such pickles, you had better make them, for they are not easy to buy at economical rates. Unfortunately, those who make their own pickles, following the directions of the older cookery books, or practicing after the examples of our grandmothers, furnish the cue to the adulterators. It was, and still is, a custom among New England housewives to prepare their cucumber pickles by boiling the vinegar in a brass kettle, or by steeping the cucumbers and vinegar together in brass, until they acquire a nice green color from the dissolved copper, adding also a lump of alum to make the pickles firm and crisp. In making pickles for the market, such as you may eat with your oysters at the common restaurant, dilute sulphuric acid is used in place of most of the vinegar, and the dose of copper is administered in the shape of verdigris or blue vitriol, while alum is of course added in liberal measure. These pickles are cheap; they are crisp and brittle and of a fine color, although very unpalatable to those who know what a good pickle is, and if eaten in any considerable quantity are dangerous, not only because they are indigestible, but because they are loaded with metallic poison. Instances of the fatal results of their use are on record. Dr. Hassall states that in the examination of twenty-three samples of London pickles of various kinds, he found in most cases the vinegar very weak; in nineteen instances a good share of their acidity was due to sulphuric acid; sixteen samples contained copper, three in very considerable amount, one in a highly delerious and two in poisonous quantities.

Vinegar, as retailed for household use, is mainly adulterated with water to cheapen it, with sulphuric acid to make it sour, and finally with burnt sugar to restore the color lost by dilution. The use of sulphuric acid as an adulterant has led to the introduction of arsenic into vinegar, especially in England, where sulphuric acid is largely prepared from pyrites which are frequently arsenical. This however sounds worse than it really is, because the sulphuric acid contains but very little arsenic, the vinegar contains very little sulphuric acid, and people commonly swallow very little vinegar at a time.

(*To be Continued Next Month.*)

CELLULOID IN A NEW ROLE.—It is reported that celluloid has of late been successfully applied in the form of a veneer in the ornamentation of furniture. It is used in this way in imitation of malachite, or colored marbles, for table tops, and for panels in imitating tortoise-shell and other costly materials.

Correspondence.

The Stover Patent Again.

TO THE EDITOR OF THE MANUFACTURER AND BUILDER:

Some time ago I called your attention to the H. D. Stover planing machine patent, stating that after long and thorough search, I became convinced of its invalidity.

In September, 1879, a suit was begun in this circuit by the New York Wood-Working Machinery Company, which is an outgrowth of the old Boston Conductory Co., against one Louis P. Grevlin, of Albany, N. Y., who, I am informed, is pecuniarly unable to defend that suit properly.

Recently I have had several interviews with Mr. Chas. E. Poucher, Jr., of Nos. 4 and 6 Warren street, this city, who has been substituted as solicitor for Mr. Grevlin, and as such has undertaken the defence of the suit above mentioned, and which I am informed is about to be prosecuted vigorously.

I respectfully request that you give publicity to this matter through the columns of your journal, that some, if not many, of your readers will be able to send to Mr. Poucher names, dates, places and other facts showing prior usage of this alleged claim of patent by Stover, and thus save a vast deal of trouble and expense to the wood-working community generally, for this suit which Mr. Poucher is defending can be made a test suit, provided he can get sufficient information, etc., to warrant his proceeding, for, as I am informed, the answer of the defendant now filed is very weak, and there is danger of a decree being made in favor of the patent, which would cause endless trouble.

The issues involved in this patent can now be settled, and I believe it to be to the interest of all parties interested in this Stover patent to come forward at this time and combine forces and make a vigorous defense to this unjust claim of patent. Yours truly,

New York, January, 1881. I. R. J.

Home Department.

Shop Libraries.

The manufacturer can hardly make a wiser or better paying investment than by purchasing a fair sized library of useful works, for the benefit of his employés. In establishing a shop library, the most natural course would be to first select volumes touching upon the particular line of industrial work engaged in by the manufactory, and second, such lighter reading as would be entertaining to the workmen and their families. Thus, if the library be in an iron foundry, the principal works would most naturally be selected for their relation to the subject of production and manipulation of iron. Within the scope of a reasonable expenditure quite a complete library could be established which would be of the utmost benefit to those having access to it. In the *American Machinist* mention is made of the library of the Brown & Sharpe Manufacturing Co., of Providence, R. I., containing some 700 volumes. This library was established in 1868, with 150 volumes, and has now grown to its present proportions. In speaking of this library, the above mentioned journal says:

"In looking over the shelves, we noticed a good sprinkling of books on subjects of general interest, as well as purely technical treatises. Biography and history are well represented, also books of geography and travels, and bound volumes of periodicals. A complete set of *Harpers' Magazine*, from the first number issued, has attracted more readers, we are informed, than any other publication in the library. The works of Dickens and Scott are conspicuous on the shelves. Among other works, we noticed 'Chambers' Miscellany,' ten volumes; 'Chambers' Papers for the People,' six volumes; 'Chambers' Journal,' twenty volumes; 'Shakespeare,' eight volumes; and several volumes of poetry. As might be expected, works on mechanical subjects are liberally interspersed. Apprentices show a leading taste for stories, also biography and history. Workmen engaged in special jobs can find books in the library containing information applying directly to the work in hand."

The advantages of libraries in connection with manufacturing institutions would be felt in many directions. To the young men in the industrial establishments it would afford an excellent storehouse of useful and entertaining knowledge. Suppose at first they do go to reading the lighter works, they are likely sooner or later to take an interest in books of science, and particularly those that pertain to their special work. Young men cannot have free access to a library of scientific works without being induced to read some of them, and the taste for knowledge once being directed in the right channel, would govern itself. But even if all of these young people should not become second Franklins or Sir Isaac Newtons, yet there is little question but that many of them would be immeasurably benefitted by the knowledge gained from the perusal of the works in a library.

The greatest advantage would likely ensue to the older workmen. Their education, and doubtless their taste, would lead them to pursue a course of reading which would enlarge their information on topics allied to their occupation; and in any event the result of their patronizing a well chosen library could only be for their intellectual and social good.

Conservatism in Business.

Conservatism in business does not allow of a trade far exceeding the bounds of capital employed. Here is also a source of danger. It is never safe to depend upon outside aid to float an extended business. The danger may be delayed when crops are splendid and the country prosperous, but sudden reactions occur frequently in trade, and money grows tight and capital timid. In such seasons the business man who has attempted to cover too much ground is often forced to the wall. Had he kept his trade under wise control, he would have passed safely through the sudden flurry. Credit and character are important in commercial affairs, and are secured only through well directed conservatism. For a man to succeed, he must concentrate his powers and abilities, mark out a safe, straight line, and steadily pursue it. He will find in the long run that one pursuit furnishes ample scope for all his energies, and if wisely followed will bring appropriate reward.

Schoene's Pneumatic Sewerage System.

In elaborating the special features which distinguish his pneumatic sewerage system, Mr. Schoene starts out with the declaration that the very general practice of admitting rain water and sewage into the same system of conduits, is a great mistake. He holds, on the other hand, that the proper method of dealing with

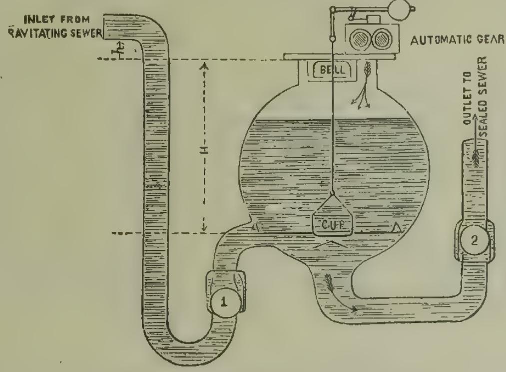


Fig. 1.—Reservoir about Being Emptied.—Inlet Closed.

sewage, is to collect it by itself, separate from the rain water, in conduits no larger than just sufficient to perform that duty.

This idea is not altogether new, having had advocates for the past twenty years, and having been practically adopted substantially as above described, in the English towns of Richmond, Oxford and Reading. It has the prominent merit of permitting of the subsequent utilization of the sewage upon any of the plans that have been proposed for the purpose.

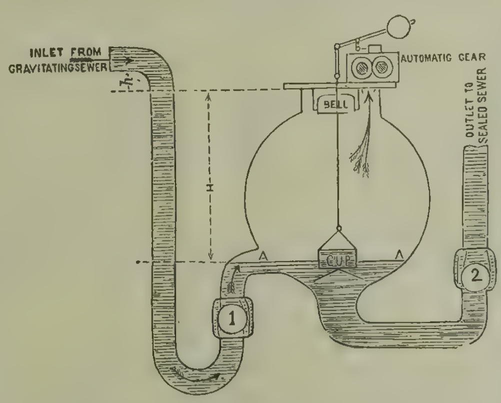


Fig. 2.—Reservoir Emptied.—Inlet Opened.

One of the chief practical difficulties in the way of this plan, resides in the fact that pipes of such limited dimensions as those proposed, will not be self-cleansing unless a fall sufficient to give the sewage a velocity of flow of about $2\frac{1}{2}$ to 3 feet per second. A fall sufficient for this can readily be obtained in hilly districts; but in towns built upon a comparatively flat surface, it will generally be found impracticable to obtain the slope required for the collection of the sewage at any one or more localities. For this purpose, therefore, recourse must be had to pumping, by which the sewage may be lifted to a higher level, from which it will be delivered to the required point by gravity, and from which it can be distributed upon the land for agricultural purposes, or subjected to chemical treatment. For this purpose a number of towns have erected pumping works. But as steam pumping machinery is expensive to operate, these are, for economy's sake, concentrated at one place, to which all the sewage must be brought, no matter what obstacles the grades may interpose.

It is to overcome this difficulty that Mr. Schoene has devised his ingenious pneumatic system, by which the sewage of towns may be raised to higher levels, not only after its collection, but at as many points along the line of flow as may be necessary, by the application of compressed air conveyed to the required points in small pipes laid beneath the surface. Mr. Schoene calls this device a "sewage ejector." It is shown very clearly in the annexed diagrams, and from the following brief description it will be observed that it substantially fulfills the functions of a pump.

The sewage is allowed to run into the spherical vessel through the pipe on the left. When filled, an inverted cup, marked "bell," at the top, is floated, by means of which, and a counterpoise on top, a small valve is shifted. This admits the compressed air to shift a larger valve, by which the pressure is applied to the surface of the sewage by the flow of compressed air into the top of the vessel. Its contents are thus pressed out through the pipe on the right, lifting a ball valve in this marked "2," while closing one in the pipe on the left marked "1." The sewage is thus pushed off under pressure into a force main to any desired place. When the vessel is emptied, the cup near the bottom, being no longer supported by the fluid, pulls down on the suspending rod and shifts the valve, closing the entrance for compressed air and opening the exhaust port. The sewage is then free to flow into the vessel again as at first, and the operation is repeated as often as the vessel is filled, provided a supply of compressed air is maintained at a proper pressure.

The degree of pressure needed depends, of course, upon the hight and distance to which the sewage is to be forced. One additional atmosphere, or $14^{6}/_{10}$ pounds, per square inch will avail for about 30 feet of hydraulic head. For this purpose one or more air compressors must be provided, at a convenient place, with a reservoir or tank from which a supply of compressed air can be conveyed to any spot where it is desired, in iron pipes.

This apparatus has a number of meritorious features. It can be applied at any point to which sewage may gravitate, and where it would be impracticable to erect a pump; so that advantage can be taken of the best gradients in applying the system. Compressed air can be conveyed to any distance from a central station with but comparatively little loss, and as a substitute for a number of independent pumping stations, it must be considerably more economical than the latter.

Stick to Your Business.

There is nothing which should be more frequently impressed upon the minds of young men than the importance of steadily pursuing some one business. The frequent changing from one employment to another is one of the most common errors committed, and to it can be traced more than half the failures of men in business, and much of the discontent and disappointment which render life uncomfortable. It is a common thing for a man to be disappointed with his business, and to desire to change it to some other, which, it seems to him, will prove a more lucrative employment, but in nine cases out of ten it is a mistake. Look around you and you will find among your acquaintances abundant verifications of our assertion. There is an honest farmer who has toiled a few years, got his farm paid for, but does not grow rich very rapidly, as much from lack of contentment mingled with industry as anything, though he is not aware of it. He hears the wonderful stories of California, and how fortunes may be had for the trouble of picking them up; mortgages his farm to raise money; goes away to the land of gold, and after many months of hard toil comes home again to commence at the bottom of the hill for a more weary and less successful climbing up again. Mark the men in every community who are notorious for never getting ahead, and you

will find those who never stick to one business long, but are always forsaking their occupation just when it is beginning to be profitable.

Instantaneous Photography.

In spite of the remarkable improvements that have been made in the art of photography since its comparatively recent discovery, it is very probable, in view of certain late advances that we are called upon to record, that we are yet merely upon the threshold of discovery in respect to the light sensitiveness of matter. The improvement to which we wish here to specially refer, relates to the preparation of photographic plates of such extreme sensitiveness that the time required for exposure is practically instantaneous. The advantages of this improvement are manifold. It enables the operator to seize upon the favorable moment to catch the attitude or expression that strikes his artistic fancy. It obviates the many disagreeable incidents which all of us will recall as necessarily associated with the task of sitting for a picture; the barbarous head-rest, within whose clutch the effort to assume a pleasant expression becomes a disgusting failure; the fixing of the eyes upon some particular spot, or upon vacancy, until the head swims, and the other unpleasantnesses that our readers will recall on reading this.

We have had the opportunity of observing the practical working of this new departure in photography, at the hands of Mr. G. G. Rockwood, of 17 Union Square, this city, whose results with the so-called bromide emulsion process are as beautiful as they are astonishing. The process in question, we understand, is the outgrowth of a series of investigations conducted by Capt. Abner Herr von Monckhoven, and other well-known men of science, to devise a process which should make the photographer practically independent of the condition of the atmosphere, and which might be used, if necessary, with the aid of artificial light. The results attained have been eminently satisfactory. Pictures may be taken upon these plates in the fraction of a second. Objects in motion no longer interpose any obstacle to the photographer—a new era has dawned upon the art.

The advantage of the new process, with its marvelously sensitive plates, is not confined to portraiture, but every conceivable incident of real life—the trotting horse, the frolicking group of kittens, the animated scene of the harbor, the crowded ball-room with laughing groups of dancers—all these can with equal ease be fixed indelibly upon the plate. Our readers can better imagine than we can describe the possibilities which this latest advance in the most beautiful of the arts has opened.

Mr. Rockwood has made remarkably successful use of the new process, and a visit to his rooms will amply repay the trouble.

Von Laer's "Perfect" Binder.

This device is intended to serve either as a temporary or permanent cover for the preservation of periodicals, pamphlets, sheet-music, manuscripts, and the like, and possesses certain very decided points of superiority over the binders in common use, in that it dispenses with the use of needles, or the punching of holes in the papers, by which they are frequently mutilated, while it has the special merit of permitting the removal of any one of the enclosed papers, for reference, without disturbing the others. Both of these features our readers will recognize as being specially meritorious. The binders in common use, in which the papers are secured with the use of a needle and thread, are simply nuisances and unworthy of the name.

The following description will give our readers an idea of the construction of the Von Laer binder: It is substantially a complete book cover, provided with devices for holding within it a limited quantity of pamphlets, newspapers, sheet-music, etc., which may be inserted, one or more at a time, and with equal facility be removed. The device for holding the sheets or pamphlets in place, consists of a rigid back piece, neatly and firmly secured within rigid covers; mounted on this firm back are flat metallic slats, hinged upon a rod extending across the top of the back, and made removable at the bottom. To enter a paper, a slat is unlocked at the lower end, and the paper being opened to its central fold, is passed around or behind the slat, which latter, being again securely locked to the back, holds the paper firmly within the covers. No holes are required to be made in the papers, nor are they in the least degree liable to injury from the remaining slats, and but very little time is required to insert a paper in the binder.

The binder is manufactured to order of special sizes, to suit publishers of magazines, etc., with title, volume, etc., stamped upon the back. The invention is a very practical one, and comes nearer to the requirements of a binder than anything of the kind we have yet seen. The manufacturer is E. L. Lambie, Lock Box 300, Washington, D. C.

The Cause of Malarial Fever is ascribed by Messrs. Tomassi and Klebs, to the presence in the atmosphere and in the soil of an infected district, of a microscopic fungus consisting of movable shining oval spores, which they have succeeded in detecting and identifying. To test the accuracy of their observation, the fungus was injected under the skin of dogs, with the result that the animals impregnated with the poison manifested unmistakable symptoms of malarial fever, with intervals of repose for sixteen hours, elevation of temperature to 107.6° Fah., and enlargement of the spleen, in which, as well as in the lymphatic vessels, a large amount of the fungus in its characteristic form was observed. The authors propose to name this fungus *Bacillus malariae.*

Miscellaneous and Advertising.

There are now sixteen broom factories managed by Chinese in San Francisco.

The dentists of the United States are said to use no less than half a ton of gold a year for filling teeth.

J. A. Fay & Co. report business still very active, and they have recently been obliged to employ an increased force of workmen in order to meet their orders.

The George Place Machinery Agency, of 121 Chambers street, this city, have always on hand a large line of new and second-hand machinery of every description.

The George F. Blake Manufacturing Co., of New York and Boston, have just completed a large addition to their factory. They have a large number of orders, and are running full on extra time.

Applications for space by those intending to send objects for exhibition to the International Exhibition of Electricity, to be held in Paris next Autumn, will be received until March 31. There will be no charge for space, but those who will require steam power must pay some fixed rate.

A French paper-maker recently tried an experiment in the manufacture of his paper, by which he introduced a sufficient amount of ultramarine green to give it a delicate green tint. After the paper was finished and lithographed like a bank draft, it was written upon with a slightly acidulated ink, the writing appearing in a clear, plain, white streak upon a light green ground. It would seemingly furnish excellent protection against tampering.

E. E. Garvin & Co. have been engaged in the manufacture of machine tools at 139, 141 and 143 Center street, New York, for about two years. They began in a small way, but now have sixty men constantly employed, and find it difficult to keep up with their orders, which come from all parts of the country. They have recently made some important improvements in milling machines and other tools, which are set forth in a new illustrated catalogue just issued.

Carnegie Brothers & Co., of Pittsburgh, Pa., are always pleased to furnish estimates to architects, contractors and others for their patent wrought-iron beams and girders; and in view of the slight difference in the cost of wood and iron, this firm call attention to the advantages of the latter material, lessening as it does the cost of insurance and the serious losses and interruption to business caused by fire.

The Akron Sewer-Pipe Company, of Akron, Ohio, manufacturers of standard Akron salt-glazed sewer-pipe, are having a large and increasing demand for their product, and those who have used this pipe will employ no other. As the company use the greatest care in manufacture, their product can be always relied on to be perfect and capable of withstanding the severest tests to which a sewer-pipe can be subjected.

Babcock & Wilcox, of 30 Cortlandt street, this city, report a large number of orders ahead for their water-tube steam boilers. The business of this enterprising firm has been increasing year by year until it has reached extensive proportions, and the sales so far this year indicate a large increase of business over 1880, in which the firm sold the greatest number of horse-power of any year since this boiler has been in the market.

Design for a Row of Dwellings.

Buildings according to the plans on the opposite page will be found to be a desirable investment in certain localities. These plans were prepared for a manufacturing town in New Jersey for occupancy by the factory hands, and are arranged for letting each house entire, or separately in floors. If let in floors a better return on the investment can be made.

The four houses will cost to build $6,000, and placing the cost of the land at $2,000 (this will of course vary), the total cost to owner will be $8,000.

Renting the houses separately at $20 per month will bring an income of $960. Deducting 3 per cent for taxes, repairs, etc., leaves a balance of $720, or 9 per cent on the investment.

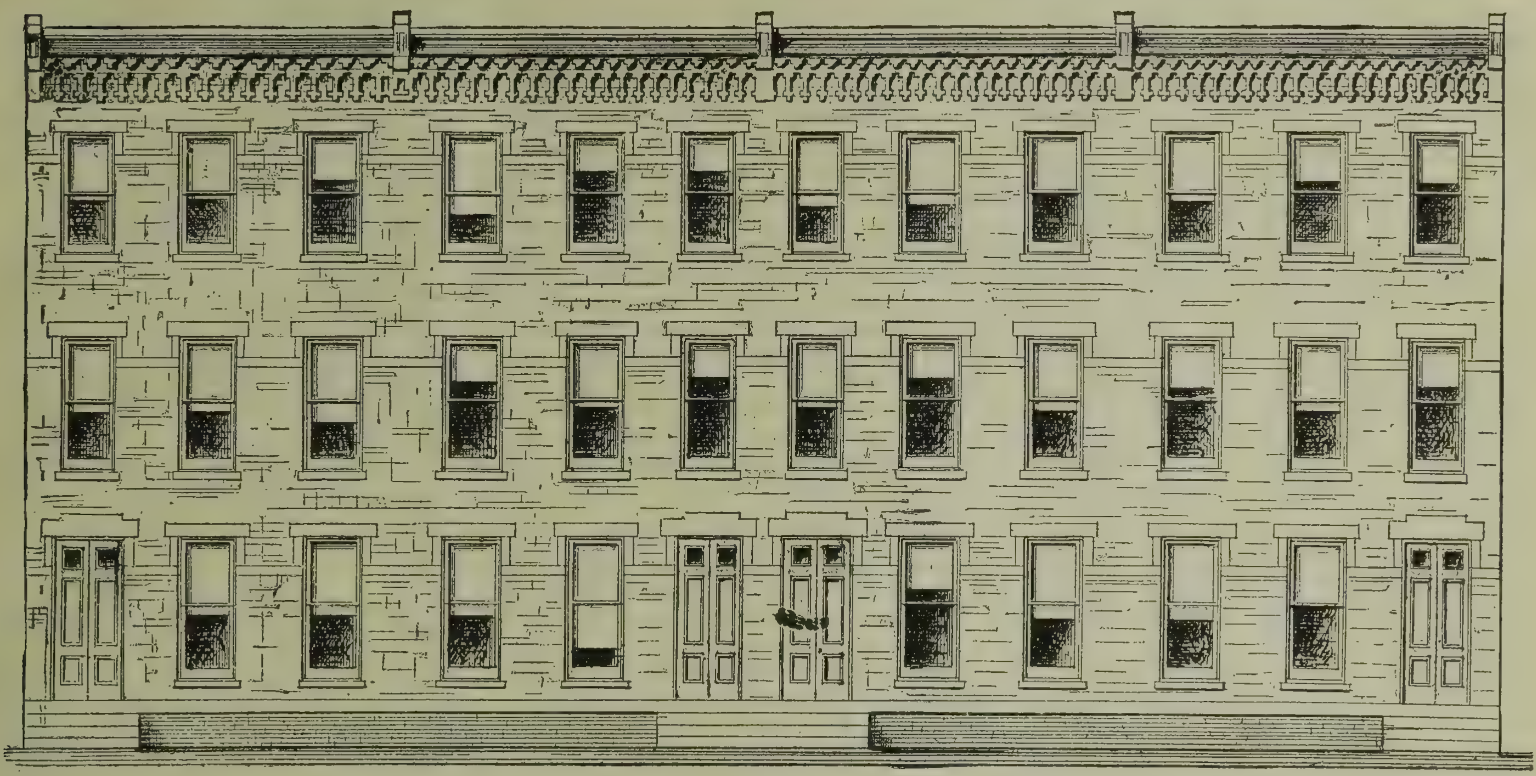
The workmanship and material in these houses is of first quality, though the finish is plain. The rooms are all of good size, with ample closet space, and each room has direct communication with outside light and air; a necessary feature in buildings of this class. The arrangement of rooms need not be described here at length, as it can be seen by referring to the plan. Each of the "bedroom floors" is arranged as the first floor here shown.

The cellar is supplied with coal and wood bins, and space has been left for a furnace should it be desired to put one in—though this item has not been included in the estimate.

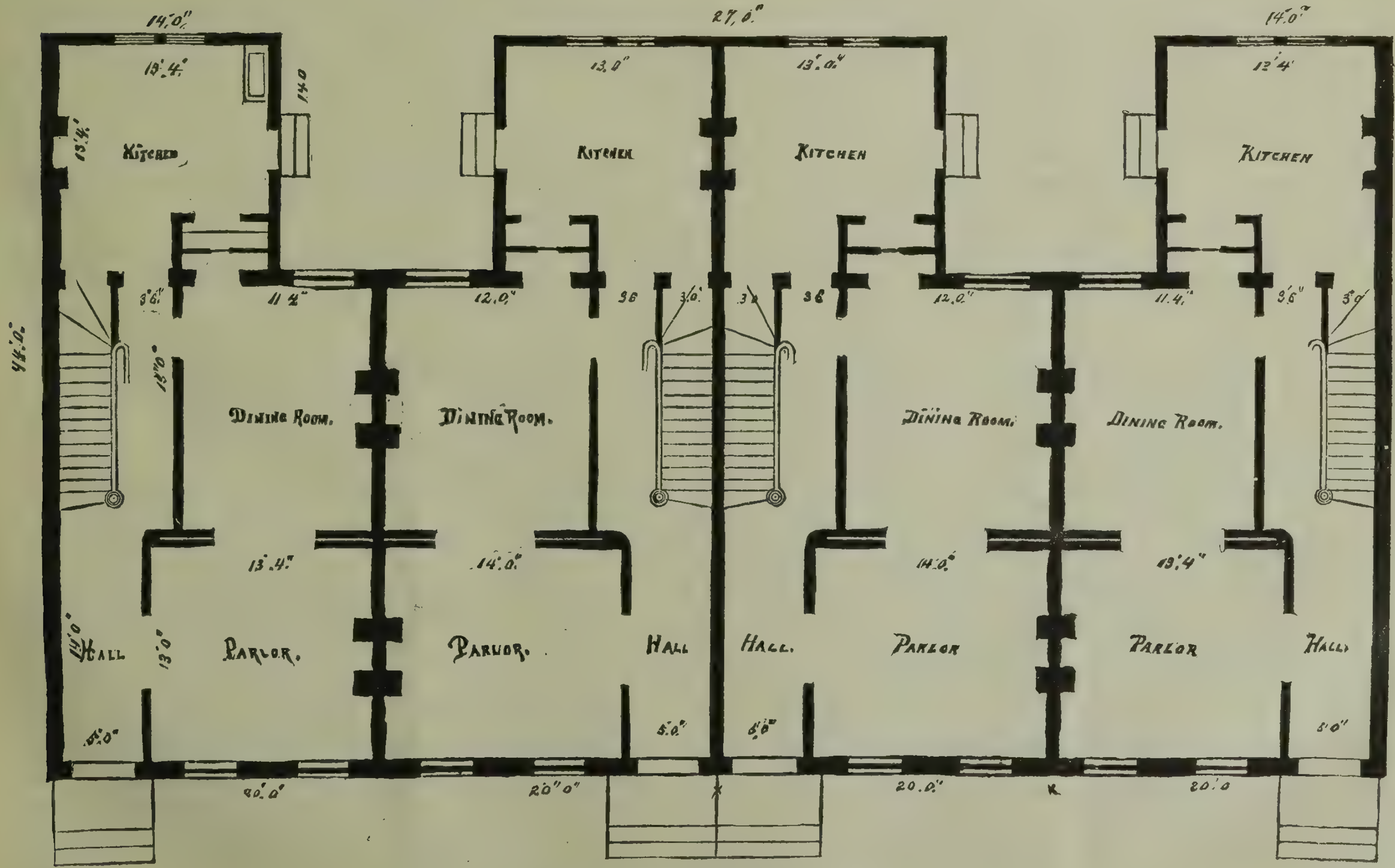
Gas and water pipes are carried through the house, and where the house is to be let entire, one room in the extension can be arraged as a bathroom—which was the original design, though afterwards changed by the owner.

The construction of the buildings is as follows: Outside and party walls of brick on a twenty-inch foundation of stone. The brick walls are twelve inches thick to underside of third story beams, thence to top 8 inches. The timbering is of hemlock; first and second story beams 3 by 8 inches; third story 2½ by 8 inches; roof beams, 2 by 8 inches. Window and door studs 3 by 4 inches; filling-in studs 2 by 4 inches; girder in cellar 6 by 8 inches, supported on 6 inch chestnut posts. The flooring throughout is of white pine. The cornice is of white pine on brick corbellings. All the outside wood and tin work and inside wood work is painted.

The architects are Smith & Howe, of 7 Warren St., New York City, from whom any further details in relation to these houses can be obtained.



DESIGN FOR A ROW OF BRICK DWELLINGS, COSTING $6,000.



PLAN OF FIRST FLOOR.

Where and How to Place a House.

On the location of a house, says the *American Architect*, much of the comfort and happiness of the occupants will depend; and yet this very important subject rarely receives attention. There are comparatively few who ever give it a thought, and the mistakes that are made in this way are usually not discovered until it is too late to rectify them. When the house is completed, the owner sees that the design has been faithfully carried out; still he is not quite satisfied—in fact, he feels there is something wrong, but what it is, or how it is to be obviated, is past his comprehension. Some day a friend, more observing, or who has bought his experience, asks why, in arranging his house, he put the best rooms where neither the sun nor the summer breeze can reach them. Then the whole thing comes to him, and he finds that he has not only turned his back on the pleasant outlook, which has always been one of the attractions of the place, but that he has also sacrificed what would have been a continual source of enjoyment, to some fancied advantage of a short cut to the road.

One of the first questions an architect should ask, when his client talks of building, is, "Where is the house to be located?" To this question there frequently comes the reply, "Oh, I have not yet purchased a site; I thought I would get my plans first, and then, if I think as favorably of building as I do now, I will buy a lot and go on with the work at once." One could hardly make a greater mistake than to proceed in this way. The house should be adapted to the site, for the site cannot be made to conform to the house. By accident—one chance in a thousand—the design selected may happily meet the requirements of the site; but the probabilities are that it will be found to be wholly unsuited when the purchase of the land has finally been made, in which case it must be abandoned. If carried out, the step will be a source of regret in after years.

We are very dependent on our surroundings—far more so than we are aware. We love to look out over a pleasant sweep of country—out on the ocean, and on wooded hills; we like the sunshine, and take no pains to exclude it from our dwellings; we hail its advent in the morning, rejoice in its noonday glories, and follow it with loving eyes, and its stay is never too prolonged; the young are gladdened by its presence, and the old bathe in it and are refreshed. Cold and cheerless is the room that is never enlivened by its presence, and the spot is unhealthy on which it never beams. And so of the prevailing winds. We want to get away from the wintry blasts, but love to open our doors to the breath of spring. A piazza on the north side of a house is a useless appendage. There it stands, neglected and uncared for. Even the vines that we plant around it are slow to send forth their tendrils, and the robin and swallow will never build beneath its roof if they can find a shelter elsewhere. Our winters are too severe to be disregarded, and the summer is too short for us to lose any of the delights that are only to be enjoyed from a southern exposure.

There is one other point connected with the location of a house. I would have with every dwelling a patch of green sward, and room for a few shrubs and flowering plants. All this, I am aware, involves an outlay, and every prudent man will so govern his expenditures that they do not exceed his means. But if he builds at all, it should be where he can have breathing room, and a few rods of land that he can improve by planting. Land near to great centers may be too high to admit of his indulging his taste in this way, in which case let him push out a little on the line of improvement, and secure a larger patch, which will increase quite as fast in value as his capital would pile up, if put out at interest.

Detached houses in the suburbs are far better than rows of brick houses in town—the latter, all run together, line upon line, with scarce an open space in miles of streets—a dull, dead monotony, and interminable uniformity, with no sign of verdure, save a few sickly trees; no hedgerows and fields, but one dusty way, and one odor from imperfectly ventilated sewers, unwashed gutters and escaping gas. Those who live in such quarters, come and go, day in and day out, with the same listless air. No man takes an interest in aught around him, for no one is happy and contented; and while all would appreciate a change, there is no one to lead the way. Bad as this is to one who has become hardened to it, it is worse to one who has known the charm of living in a rural neighborhood. Southey wrote to his wife from Norfolk, in anticipation of a stay in London: "To talk about and never see green fields, or running brooks, or setting sun! Will it not wither up my faculties, like some poor myrtle that in the town air dies in the parlor window?"

But give to every toiler a little patch beyond the confines of a city, and life for him and his family will have new attractions. In a modest building, with his wife and children to help him, he will take pleasure in beautifying the spot he has chosen for his home. So employed, he will be a better and a happier man.

The Next Century's Progress.

Some practical jokers in England have issued a number of the London *Times* for the year 1980, following very closely the style of writing, the advertisements, the make-up and general typographical appearance of this well-known paper of to-day, except as the internal structure of these are changed by the supposed improvements of a century. The chief features of difference are found in the entire and absolute supremacy of women in government and social life, and in the free use of flying machines, which allow the supposed inhabitants of the world at that era to make journeys at pleasure through the air, to such distant points as the planets Juno and Mercury. Throughout all these exaggerations care has been taken to preserve the soberness and gravity of language which characterize a large part of the higher class of journalistic writing in England at the present day. Though the authors of this elaborate joke are not known, it has been hinted that the comedian Florence has had a hand in its preparation, and an edition of this advanced journal will no doubt be brought out in this country.

New Publications.

Hand-Book for Steam Engineers and Owners of Steam Engines; being a Practical Guide to the Selection and Care of Steam Machinery. By William M. Barr. Indianapolis, Ind.: J. H. Kerrick & Co. 1880.

Mr. Barr has acquired somewhat of a reputation as the author of several very useful and reliable books relating to steam machinery, which we have favorably noticed. The present volume likewise meets with our approval. It is a compact and convenient hand-book, specially intended to give those who are but slightly acquainted with the subject a knowledge of the principles and action of the steam engine, giving also in addition to this, a number of useful hints as to the selection of steam machinery, and advice as to its care and management when in use. Mr. Barr's book is divided into ten chapters, which treat respectively of: Fuel and Combustion; Heat and Steam; Selection of a Boiler; Boiler Appendages and Furnace; Care and Management of a Boiler; Boiler Explosions; Selection of an Engine; Care and Management of an Engine; Portable Engines; Care and management of a Locomotive. The various topics treated of under these chapter headings are paragraphed, each subject being distinguished by heavy black type, to facilitate reference; and so far as we have examined it, the work is accurate in statement, free from needless technicalities, and as comprehensive as could be expected of a book of such modest dimensions.

Modern Architectural Designs and Details. Part III. Plates. Bicknell & Comstock, 194 Broadway, New York. 1881. Price, $1.

Part III. of this admirable contribution to architectural literature has come to hand since our last notice, and fully justifies the favorable opinion we have expressed concerning its merits from the inspection of the preceding parts. The contents of Part III., like the earlier ones, embrace eight plates, numbered from 17 to 24. The subjects are as follows: Plate 17.—Six elevations and three plans of low-priced cottages, in Queen Anne style, costing from $500 to $1,500, and upwards, according to locality and style of finish; scale, three-32d in. to 1 foot. Plate 18.—Two designs and details of summer houses; scale, ½ and ¼ in. to 1 foot. Plate 19.—Perspective view and plans of house suitable for seaside, summer or Southern residence; scale, one-16th in. to 1 foot. Plate 20.—Three elevations of design plate 19; scale, ⅛ and one-16th in. to 1 foot. Plate 21.—Framing plans of design plate 19; scale, one-16th in. to 1 foot. Plate 22.—Exterior details of design plate 19; scale, ½ in. to 1 foot. Plate 23.—Interior details of design plate 19; scale, ½ in. to 1 foot. Plate 24.—Nine designs of window sash, Queen Anne style; scale, ¾ in. to 1 foot. Builders and architects will find this publication very useful.

American Newspaper Annual. Philadelphia: N. W. Ayer & Son, Newspaper Advertising Agents. 1880.

This is a handsomely printed quarto volume of some 600 pages, prepared by one of the leading houses in the advertising business, for the use of publishers, advertisers and others to whom special information respecting the newspapers of the country is of value. The following statement of the ground covered by the Annual will give an idea of its utility: The work contains a carefully prepared list of all newspapers and periodicals published in the United States, Territories and the Dominion of Canada, with valuable information regarding their circulation, issue, date of establishment, political or other distinctive features, and advertising rates; together with the population of the cities and towns, as well as of the counties, in which they are published. The arrangement of the catalogue is by States and counties.

The purpose of the Annual is to assist advertisers in making a selection of papers that will best serve their purposes in the territory they desire to cover. So far as we have been able to examine the work, the catalogue is very full and correct, and it will doubtless prove of value to those for whom it is specially designed.

Schiller and his Times. By Johannes Scherr. Translated from the German by Elizabeth McClellen. With illustrations. Philadelphia: Ign. Kohler. 1880. Price $2 to $3.

In this delightful volume Scherr has given us a charming picture of a pure and noble character animated by the highest aspirations. We gain from its perusal new thoughts and ideas respecting many of the famous works of this poet and dramatist, as his biographer in his entertaining and instructive history develops the inciting cause and motive of many of Schiller's masterpieces. To all who admire the works of the great German, we commend Scherr's picture of his life, with the assurance that they will ever look upon it as an indispensable companion volume to the poet's works.

The translator has performed her task in a manner that could not be excelled, showing that she possesses not only an intimate familiarity with the nicest shades of idiomatic German, but that she is in full sympathy with the spirit that breathes throughout Scherr's charming biography.

Drainage for Health; or, Easy Lessons in Sanitary Science. By Joseph Wilson, M. D., Medical Director United States Navy. Philadelphia: Presley Blakiston. 1881. Price $1.

The scope of this excellent volume is somewhat more comprehensive than that of most of the sanitary manuals. The author goes beyond the dwelling house and the city, and treats of the importance of land drainage and the drainage of the farm-house and village, in addition to his discussion of the subject of the drainage of cities. The work, therefore, will be of value to farmers and the inhabitants of rural towns and villages, to whom a knowledge of sanitary laws is of quite as much importance as to the dwellers in cities. The work is written in familiar style, and besides being highly instructive, will be found to be very entertaining.

OTHER PUBLICATIONS RECEIVED.

Vick's Floral Guide for 1881. Rochester, N. Y.: James Vick.

American Chemical Journal, New York. Vol. II., No. 4. October, 1880. From the editor.

Census Bulletin No. 28. New York State in part. Department of the Interior, Census Office, Washington, D. C.

Report of the Mississippi River Commission. Letter from the Secretary of War, transmitting the preliminary report of the Mississippi River Commission to Congress.

Annual Report of the Chief of the Bureau of Statistics on the Foreign Commerce of the United States, for the Fiscal Year ended June 30th, 1880. Washington: Government Printing Office.

Letter from W. W. Corcoran, Chairman of the Joint Commission for the Completion of the Washington Monument, transmitting the annual report of the engineer in charge, to the Senate and House of Representatives.

United States Commission of Fish and Fisheries. Part VI. Report of the Commissioner for 1878. A. Inquiry into the Decrease of Food-Fishes. B. The Propagation of Food-Fishes in the Waters of the United States. Washington: Government Print. 1880. From Prof. Spencer F. Baird.

Summary Statement of the Imports and Exports of the United States, for the month ended October 31, 1880, and for the ten months ended the same, compared with the corresponding periods of 1879. Prepared and published by the United States Bureau of Statistics. [Corrected to December 16th, 1880].

A Lecture on the Improvement of the Danube at Vienna, delivered before the Society of Austrian Engineers and Architects, on March 18th, 1876, by Sir Gustave v. Wex, Imperial Royal Ministerial Counsellor and Chief Director of the Improvement of the Danube. Translated by G. Weitzel, Major of Engineers, Brevet Major-General U. S. A. Washington: Government Printing Office. 1880.

We are indebted to the American Institute of Mining Engi-

neers for the following papers: The Eighty-Ton Steam Hammer at Creusot, by J. N. Herrick, M. E., Pittsburgh, Pa. On the Weight, Fall and Speed of Stamps, by Adjunct Professor H. S. Munroe, E.M., Ph.D., School of Mines, New York city. The Determination of Sulphur in Sulphides, and in Coal and Coke, by Thomas M. Drown, M.D., Lafayette College, Easton, Pa. On Rail Specifications and Rail Inspection in Europe, by C. P. Sandberg, C.E., London, England. The Cost of Milling Silver Ores in Utah and Nevada, by R. P. Rothwell, M.E., New York city. The Chemical Reactions in the Bessemer Process, the Charge Containing but a Small Percentage of Manganese, By Charles F. King, Newport, R. I. The American Bloomary Process for Making Iron Direct from the Ore, by T. Egleston, Ph.D., School of Mines, Columbia College, New York city.

Pennsylvania Second Geological Survey. G G—The Geology of Lycoming and Sullivan Counties. With two colored geological county maps, and numerous illustrations. By Andrew Sherwood and Franklin Platt, Assistant Geologists. GGG—The Geology of Potter County, by Andrew Sherwood. Report on the Coal Fields, by Franklin Platt. With a colored geological map of the county, and two-page plates of sections. H 5—Report of Progress in Armstrong County, by W. G. Platt. With a colored map of the county. III—The Geology of the Oil Regions of Warren, Venango, Clarion and Butler Counties; including surveys of the Garland and Panama conglomerates in Warren and Crawford, and in Chatauqua County, N. Y. Description of Oil-Well Rig and Tools, and a Discussion of the Pre-glacial and Post-glacial Drainage of the Lake Erie Country, by John F. Carll. With two indices and an atlas of twenty-two sheets of maps, well sections, and working drawings of well rig and tools. O O—Catalogue of the Geological Museum, by Chas. E. Hall. Part II. 1. Collection of rock specimens. 2. Palæontological specimens. R—The Geology of Potter County, and its Connection with that of Cameron, Elk and Forest, by Chas. A. Ashburner. Illustrated by thirty-three page-plates and two maps, and accompanied by an atlas containing eight sheets of maps and sections. V V—The Geology of Clarion County, by H. Martyn Chance. With a geological map of Clarion county, a map of the anticlinals and oil belt, a contoured map of the old river channel at Parker, four page plates, and eighty-three local sections figured in the text. All Harrisburg: Published by the Board of Commissioners for the Second Geological Survey. 1880. From Hon. F. A. Osbourn, Philadelphia.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of THE MANUFACTURER AND BUILDER. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2761) HORSE-POWER OF BOILERS.—Please give me a safe working rule by which to calculate the horse-power of a steam boiler.—J. N. B., Springfield, Ill.

(2762) CRUSHING STRENGTH OF BRICKS.—Having read the able reply to B. F. M. in the December number of your journal, on the incrustation of brick walls, I feel prompted to ask at your hands an answer to another question, namely: I have a piece of brick-work, built of common brick and common mortar; hight, 10 feet; length, 4 feet; and 9 inches thick. Now what I want to know is this, How much weight can I place upon it with safety? Being engaged in the building business, I should consider it a favor if you would give me a formula for calculating the bearing strength of walls of different thicknesses.—S. B., London, Ont., Canada.

(2763) JUDGING DISTANCES WITH ONE EYE.—I have read the statement that a person with only one eye could not judge accurately of distances. This does not appear to me to be true, from my personal experience by closing one eye. I would like to see what you have to say about it.—H. V. R., Brooklyn, N.Y.

(2764) POWER OF ENGINES.—What is considered good economical practice as to power yielded, based on fuel consumption in the boiler?—R. S., Decatur, Ill.

(2765) COPPERAS FROM WASTE ACID.—I am thinking of utilizing some waste liquors from pickling iron castings, but do not know if it will pay for the trouble of saving the stuff. Please inform me how much copperas a carboy of sulphuric acid ought to give.—A. P. R., Baltimore, Md.

(2766) VEGETABLE IVORY.—Is the substance called "vegetable ivory" really a product of the vegetable kingdom?—T. F. H., Minneapolis, Minn.

(2767) TRANSPARENT LACQUER.—I will thank you to give an old subscriber a recipe for making a transparent lacquer or varnish of different colors, suitable for ornamenting metallic boxes, toys, and so forth.—F. X. McM., Titusville, Pa.

(2768) DEODORIZING PETROLEUM.—What is the best deodorizer or deodorizing process for petroleum—kerosene—without in the least impairing its virtue?—J. A. B., Yonkers, N. Y.

(2769) FREEZING WATER UNDER PRESSURE.—Have any experiments ever been tried to ascertain if great pressure had an influence on the freezing point of water?—J. D. C., Denver, Colo.

(2770) RAILROAD SIGNALS.—Please give in your valued answers to correspondence an explanation of the various signals used on the railroads of this country, and oblige.—M. F., Utica, N. Y.

(2771) QUANTITY OF AIR TAKEN INTO THE LUNGS.—What is the quantity of air taken into the lungs at one inspiration? Also, how much air will a full-grown man breathe in a day?—A. R. F., St. Mary's, Md.

(2772) MARQUETRY AND BUHL.—What is the precise definition of Marquetry and Buhl work in cabinet-making?—W. D. H., Easton, Pa.

(2773) TRANSLATION OF A FRENCH SENTENCE.—Please give a good English translation of "*Un couloir portant toutes les palettes*," used in connection with the description of a grain cleaner.—INQUIRER, New York City.

(2774) PASTEUR ON VINEGAR-MAKING.—On page 279 of your December number for 1880, appears an article on an "Improved Process for Making Vinegar," and refers to a late issue of *Dingler's Polytechnisches Journal* for the whole process. Being anxious to see the article, I take the liberty of writing you to learn of whom the journal can be purchased. Hoping you will be able to give me the information without much inconvenience to yourself, I remain a subscriber or purchaser from No. 1, Vol. I., to date.—A. VAN V., Jordan, N. Y.

(2775) IMPORTATION OF POLISHING POWDERS.—Please ascertain the amount of foreign tripoli annually imported into this country from abroad.—D. B. S., Carlisle, Pa.

(2776) ESTIMATE FOR A BRIDGE.—I desire to know the probable cost of a bridge spanning about 80 yards and about 25 feet wide, made of wire. Which would be cheapest, wood or wire? I would like to see a draught from some of your contributors, of a wooden bridge.—J. D. R., Greendale, Va.

REPLIES.

(2750) BOYD'S ELECTRICAL BATTERY.—Since our last, we have made some inquiry respecting Boyd's battery, concerning which H. D. E., of Jackson, Cal., desired information. The only device of that name that we have learned of, is a flat circular disk, about the size of a half dollar, comprised, generally speaking, of a number of small circular disks of different metals, apparently of copper, brass and zinc, alternating with each other. This is to be worn upon the breast, suspended from a silken cord about the neck. It is highly eulogized in an elaborate circular, with considerable parade of scientific knowledge, as an infallible remedy for all sorts of diseases. If this is the "battery" to which H. D. E. refers, we do not "consider it to be as represented;" by which we mean that the so-called battery is one of the innumerable humbugs that are foisted into notoriety by persistent newspaper advertising and the glib tongues of peripatetic agents who peddle them about. The thing is of no earthly value, save to those interested in its sale.

(2761) HORSE-POWER OF BOILERS.—It is generally acknowledged among steam engineers that no more unsatisfactory standard has ever been employed than that of horse-power as a unit of measurement for steam boilers. But up the present time, in spite of its many objections, it is still universally employed in the rating of boilers and engines by makers and users. Many attempts have been made to fix upon some uniform and reliable method for this calculation, in which connection we may mention an attempt lately made by the Franklin Institute, but without much success. It has been proposed to rate boilers by their extent of heating surface; but boilers not only vary among themselves in the value of heating surface, but it is not of equal value in the same boiler. It has also been proposed to rate boilers by the amount of water evaporated into dry steam per hour; but this factor is also dependent upon other things than the boiler itself. It will be modified, for example, by the construction of the furnace, by the boiler-setting, by the volume and force of the draft, by the arrangement and size of the grate surface, by the condition of the heat-absorbing surfaces, and by the kind and quality of fuel used and other circumstances. Again, boilers are usually made to furnish steam to an engine. Practically, therefore, the horse-power of the engine determines the rating of the boiler. If the engine, for example, is a high-grade, automatic cut-off, the quantity of water required to be evaporated in the boiler will vary from one-third to one-half a cubic foot per hour per horse-power. If it be an ordinary slide-valve engine, then one cubic foot of water per hour per horse-power will be required. The committee appointed by the Franklin Institute to establish a rule for rating boilers, concluded, after a very full investigation of the subject, that a boiler so proportioned, as regards draft, grate surface and heating surface, as to evaporate one cubic foot of water into dry steam from and at the temperature of 212° Fah., is fully capable of yielding one actual horse-power, when used in the cylinder of an engine without expansion. When used in a three-port slide-valve engine, cutting off during the last quarter, it will yield about 1¾ indicated horse-power, and will give as high as 2½ indicated horse-power, according to the pressure of the steam, the point of cut-off, and the type and efficiency of the engine. The general considerations on which the above opinion of the committee are based, are about as follows: A grate surface so proportioned to the draft as to admit easily of the combustion of 7 pounds of anthracite coal (or combustible equivalent to that amount) per horse-power per hour, the escaping furnace gases not to have a temperature, as they leave the steam generating surface, exceeding 300° above that of the steam. To reduce the evaporative effect of a boiler with different temperatures of feed-water, and of steam produced, to its equivalent evaporation of water from 212° to steam at 212°, the committee above named give the following formula:

Let E=number of feet (or pounds) evaporated at 212° in a given time.

E 212°=number of feet (or pounds) evaporated under the conditions taken.

Tw=temperature of feed-water.

Ts=temperature of steam formed in boiler.

$$\text{Then E } 212° = \text{E}\left\{\frac{1114 + 0.305\ \text{Ts} - \text{Tw}}{966}\right\}$$

In using the above rule, proper allowance must be made for the amount of water carried over mechanically with the steam, which must be determined as accurately as possible, and deducted from the indicated evaporation.

(2762) CRUSHING STRENGTH OF BRICKS.—We cannot give this inquirer a formula for calculating the bearing strength of brick walls of different thicknesses, for the reason that the strength of bricks varies so greatly, according to quality. We give him, in what follows, the safest rule for guidance in practice, from the very reliable authority of Trautwine's "Engineer's Pocket-Book," namely: The crushing strength of bricks, of course, varies greatly. A rather soft one will crush under from 450 to 600 pounds per square inch, or about 30 to 40 tons per square foot; while a first-rate machine-pressed one will require about 200 to 400 tons per square foot. This last is about the crushing limit of the best sandstone—two-thirds as much as the best marbles or limestones, and one-half as much as the best granites or roofing slates. But masses of brick-work crush under much smaller loads than single bricks. In some English experiments, small cubical masses, only 9 inches on each edge, laid in cement, crushed under 27 to 40 tons per square foot. Others, with piers 9 inches square and 2 feet 3 inches high, in cement, only two days after being built, required 44 to 62 tons to crush them. Another, of pressed brick, in best Portland cement, is said to have required 202 tons, and with common lime mortar only one-fourth as much. It must, however, be remembered that cracking and splitting commence under about one-half the crushing load. To be safe, the load should not exceed one-eighth to one-tenth the crushing one; and so with stone. Moreover, these experiments were made upon low masses; but the strength decreases with the proportion of the hight to the thickness. The pressure at the base of a brick shot-tower in Baltimore, 246 feet high, is estimated at 6¼ tons per square foot; and in a brick chimney at Glasgow, Scotland, 468 feet high, at 9 tons. Prof. Rankine calculates that in heavy gales this is increased to 15 tons on the leeward side. The walls of both are, of course, much thicker at the bottom than at the top. With walls 100 feet high, of uniform thickness, the pressure at the base would be 5.4 tons per square foot. With our present imperfect knowledge on this subject, it cannot be considered safe to expose even first-class pressed brick-work, in cement, to more than 12 or 15 tons per square foot; or good hand molded to more than two-thirds as much. From the above, our correspondent will perceive how very uncertain it would be to lay down a formula to apply to all cases. Trautwine is a safe authority to follow, and therefore, applying the conclusion he announces in the preceding paragraph, to the case presented by our correspondent, his wall 10 feet long by 4 feet 9 inches thick, laid in common mortar, should support safely a total load of 112½ tons. Within this limit, the structure would be quite safe—the factor of safety, as regards the ultimate crushing strength of the structure, being about 10, which will be considered ample.

(2763) JUDGING DISTANCES WITH ONE EYE.—It is strictly true that a person with only one eye cannot readily judge of the distance of objects, and the failure in the case of this inquirer to demonstrate the fact by closing one eye and looking at objects with the remaining one, is no doubt due to the fact that he has experimented with objects whose relative positions and distances were already familiar to him. To satisfy himself on this point, let him try the following experiments: Close one eye and try to snuff a candle; or better, let a friend hold a pencil-point upwards before him, and let H. V. R. endeavor, with one eye closed, to touch the pencil-point with the point of another, which he must approach after estimating the proper distance, with a single rapid motion. If the candle or pencil are presented to the sight of the experimenter from behind a sheet of paper, or other obstruction, which screens the hand and person of the holder, the experiment will be still more convincing. The fact, therefore, being experimentally demonstrated that distance cannot be accurately estimated with one eye, it remains to explain why this is so. It is well known that the power of appreciating the distance and magnitude of objects is largely a matter of unconscious training, and that it depends upon a variety of circumstances, such as the optic angle (the angle formed by the lines drawn from the two eyes to the object), comparison with familiar objects, distinctness or dimness of the image, etc. It is experience that teaches us to judge of distances by the different angles of vision under which an object is observed with the two eyes, for the inclination of the optic axes, when so adjusted that the images may fall on corresponding parts of the retina, and thus convey to the mind the impression of a single object, must be greater or less according as the object is near or far off. The optic angle, therefore, is an essential element in appreciating distances. This angle, we have noticed, increases or diminishes inversely as the distance; the movement of the eyes required to cause the optic axes of the eyes to converge upon any object we are

viewing, gives us an idea of its distance; and habit and experience enable us to appreciate the relation between the distance of an object and the corresponding movement required to direct both eyes upon it. Perfect vision, therefore, cannot be had without two eyes.

(2764) Power of Engines.—The best automatic non-condensing engines yield one indicated horse-power for about three pounds of coal, supposing the coal to be of good quality and the engine to be well adapted to its work. With condensation, these figures have been, in exceptional cases, reduced as low as two pounds, although two and a half pounds is regarded as good practice. With the Perkins system of using steam of very high pressure, and with enormous expansion, a duty of one horse-power per pound of fuel has been claimed. The larger the engine, other things being equal, the greater will be the economy as compared with a smaller engine. On this subject, Barr, whose rules of practice are very sensible and reliable, has the following: For ordinary slide-valve engines, the coal burned per indicated horse-power will vary from 9 to 12 pounds. For the sake of illustration, we will say 10 pounds, and that the engine is of such a size as would require for a year's run $3,000 worth of coal. Now, an ordinary adjustable cut-off engine, with throttling governor, ought to save at least half that amount of coal, or, say $1,500 per year. If the best automatic engine were employed, using 2½ pounds of coal per horse-power, a further saving of $750 per year could be effected; or, between the two extremes, $2,250 per year in saving of coal, without in any way interfering with the power; with the exception that perhaps the automatic engine will furnish a better power than the other. It will be evident, therefore, that true economy will dictate the purchase of the best engine, where saving of fuel is an element entering into the question of selection, as it invariably is, even should the extra first cost of such an engine be considerable. In selecting such an engine, of course it will be necessary for the purchaser to exercise the best judgment, as otherwise, with a high economy of fuel, he may be subjected to vexatious and damaging delays, caused by the breaking down of the automatic mechanism of his engine. We do not urge this as an objection to which high grade engines are specially subject, but simply to indicate that with these as well as with every species of mechanism there are grades of excellence.

(2765) Copperas from Waste Acid.—Replying to this inquirer, we wish to advise him that the utilization of waste pickling liquors for manufacture into copperas is practiced successfully in many of our leading industrial centers; and he will probably find one or more establishments in his own city, if he is not already aware of the fact. The manufacture of copperas, however, to be successfully carried on, requires to be operated on a large scale; the larger the extent of the operations the greater will be the probabilities of profit, other things being equal. The business demands large neutralizing vats or receptacles; large concentrating tubes, into which the material is pumped, after being properly strained, and heated by steam, to drive off the superfluous water and bring the liquor down to the proper concentration for speedy crystallization; and finally, a considerable number of crystallizing vats. All these paraphernalia demand considerable ground space, and the attention to the details of the operations involved will be so great, that, unless our inquirer intends seriously to embark in the business on a large scale, we would not advise him to undertake it. Replying to the second part of A. P. R.'s question, we will state for his information that 100 pounds of anhydrous (dry) sulphuric acid should produce 347½ pounds of copperas. To know how much a carboy of acid would furnish, we would have to know the strength of the acid and the average number of pounds of acid a carboy contains, neither of which facts our correspondent furnishes. Supposing the acid to be 66° B.—the strongest commercial acid—then 100 pounds should yield 280¾ pounds of copperas; if the acid be 60° B., then 100 pounds should give 229⅓ pounds of copperas. In a general way, we may say that 1 pound of the oil of vitriol of commerce should yield from 2 to 2¾ pounds of copperas.

(2766) Vegetable Ivory.—Yes. The substance known as vegetable ivory is the fruit of several species of palms which flourish on the Isthmus of Darien, and especially along the banks of the river Magdalena in South America. The best known of these palms, and the species which produces the largest and best ivory nuts, is known to botanists as the *Phytelephas macrocarpa*. The fruit grows in large spherical clusters, about the size of a man's head. The exterior of these masses is rough, and in appearance they justify the name which the inhabitants give them—namely, *cabesa de negro* (negro's head). In cutting open one of these masses, there is first seen a mass of brown woody fiber, within which, concentrically arranged, are quite a number of ivory nuts—as many as 20 or 25 in a cluster. They are generally of an oval form, slightly flattened at the sides. The nuts are usually 2 or 3 inches in length. At first the interior of the nuts is filled with a clear, watery liquid, of somewhat insipid taste. This fluid gradually becomes milky, and slowly solidifies, attaining finally an extreme hardness. It then forms a pure white substance, closely resembling ivory, which may be turned and fashioned into a variety of useful shapes. It is usually manufactured into buttons and a variety of small ornamental objects, the small size of the nuts precluding their use for other purposes for which ivory is used. The ivory nuts form an important article of commerce from the Isthmus and from the Magdalena, and immense quantities of them are shipped from Aspinwall and other ports, to the United States and to Europe.

(2767) Transparent Lacquer.—For the purpose named by our correspondent, we should say that the aniline colors were excellently adapted, as they are known to be very well suited for the same class of work upon glass or mica. The best plan for making the transparent lacquer is, we think, that generally adopted for coating the latter substances, which is about as follows: Prepare separately an alcoholic solution of bleached shellac or sandarach, and a concentrated alcoholic solution of the coloring matter, which last is to be added to the lac before using it, the surface on which it is to be applied being slightly warmed before making the application. Excellent results can also be produced by using collodion instead of shellac or sandarach, in which case the coloring matter should be dissolved in a mixture of alcohol and ether. The collodion film has its elasticity greatly increased by the addition of some turpentine oil; and when applied cold, can be removed entire. Such colored films may be cut into any pattern and again attached to other surfaces.

(2768) Deodorizing Petroleum.—The method practiced in the refineries to deodorize petroleum designed for illuminating purposes, is to subject that portion of the distillate to the action of sulphuric acid, which, to a great extent, removes odor and color. An acid, tarry sediment forms, which is removed. The clear oil is then treated with alkali, to neutralize the last traces of acid. The more careful refiners then subject the kerosene to a somewhat elevated temperature for the purpose of expelling the traces of benzine which it still contains, and which imparts to it most of its pungent odor. But this last operation is not generally practiced. Where the operation of rectification is properly conducted, the resulting kerosene is very free from disagreeable odors. Pennsylvania petroleum is generally very free from sulphur compounds, which make the oils of Canada and Kentucky very offensive. For the removal of the sulphur from the last named oils, most manufacturers distill them from caustic soda, and subsequently agitate with the same agent. The second operation, however, is not very generally practiced, as it adds somewhat to the expense. It is, however, strongly recommended, as it has the important advantage of removing the last traces of the sulphuric acid used in the earlier stages of the manufacture, and this prevents the coating of the wick, which is an objectionable property of oils retaining a trace of acid. In addition to what we have already indicated for deodorizing petroleum, we should notice that litharge has been recommended and used; also nitric acid, with a little chloride of lime; and likewise superheated steam. We do not know of any process in commercial use that will perfectly deodorize petroleum.

(2769) Freezing Water under Pressure.—We are aware of but one set of experiments made for the purpose above named. They were made by the French physicist Boussingault, with the view of ascertaining the condition of water when cooled considerably below its normal freezing point, under circumstances where free expansion was prevented. For this purpose a strong cylinder of steel was filled with water at its temperature of maximum density, and a steel plug fitted tightly to the opening, thus preventing by the strength and the practically unyielding nature of the confining vessel, any expansion of the confined liquid when cooled. The sound made by the falling of a metal ball previously placed within the cylinder, told whether the water within was liquid or solid. Under these conditions, the experimenter above named found that water remains liquid even at a temperature of −18° C. (=−0.4° Fah.,) but freezes instantly so soon as the plug is removed.

(2770) Railroad Signals.—The following signals are in general use on the railroads of the United States. Some roads still employ special signals, and there is, consequently, no one established code: *Red* signifies danger, and is a signal to stop. *Green* signifies caution, and is a signal to go slowly. *White* signifies safety, and is a signal to go on. *Green and White* is a signal to be used to stop trains at flag stations. *Blue* is a signal to be used by car inspectors. Flags of proper color are used by day and lamps or lanterns of proper color by night, or in foggy weather. Red flags or red lanterns must never be used as caution signals; they always signify danger—stop. A lantern swung across the track, a flag, hat, or any other object waved violently by any person on the track, signifies danger, and is a signal to stop. An exploding cap or torpedo, clamped to the top of the rail, is an extra danger signal, to be used in addition to the regular signal, at night, in foggy weather, and in cases of accident or emergency, when other signals cannot be used or relied upon. The explosion of one of these signals is a warning to check the speed of the train immediately. A fuse is an extra danger signal, to be lighted and thrown on the track at frequent intervals, by the flagmen of passenger trains at night, whenever the train is not making schedule time between telegraph stations. A train finding a fuse burning upon the track, must come to a full stop and not proceed until it is burned out. *Engineman's Signals*—By signals: One *short* blast of the whistle is a signal to apply the brakes—stop. Two *long* blasts is a signal to throw off the brakes. Two *short* blasts when running is an answer to the signal of the conductor to stop at the next station. Three *short* blasts, when standing, is a signal that the engine or train will back. Three *short* blasts, when running, is a signal to be given by passenger trains, when carrying signals for a following train, to call the attention of trains they pass to the signals. Four *long* blasts is the engineman's call for signals. Two *long*, followed by two *short* blasts, when running, is a signal for approaching a road or crossing at grade. Five *short* blasts is a signal to the flagman to go back and protect the rear of the train. A succession of *short* blasts is an alarm for cattle, and calls the attention of trainmen to danger ahead. A blast of the whistle of five seconds' duration is a signal for approaching stations, railroad crossings and draw-bridges. *Conductor's Signals*—by bell-cord: One tap of the bell, when the engine is standing, is a signal to start. Two taps of the signal bell, when the engine is standing, is a notice to call in the flagman. Two taps, when the engine is running, is a signal to stop at once. Three taps, when the engine is standing, is a signal to back the train. Three taps, when the engine is running, is a signal to stop at the next station. *Signals by Lamps.*—A lamp swung across a track, is a signal to stop. A lamp raised and lowered vertically, is a signal to move ahead. A lamp swung in a circle, is a signal to move back.

(2771) Quantity of Air Taken into the Lungs.—The quantity of air that a fully developed adult can take in at a single inspiration, will be from 5 to 7 pints. This is the maximum, and can only be accomplished with an effort. With an ordinary but full inspiration, he will inhale about 2½ pints; and when perfectly tranquil, and unconscious of the act, he will inhale about a pint. Estimating 18 as about the average number of inspirations per minute, the above would make the bulk of air drawn and thrown out again, under ordinary circumstances, about 18 pints per minute—1,000 per hour, or 3,000 gallons a day. Some place the average requirement for an ordinary man somewhat higher—at about 4,000 gallons per day, and as high as 7,500 gallons per day for a muscular man undergoing severe exercise.

(2772) Marquetry and Buhl.—Both of these terms refer to different methods of ornamenting cabinet-work, by what is known as inlaying. Where the inlaying is done with various kinds of wood, the work is called Marquetry; but when done with brass or tortoise-shell, it is called Buhl-work, from the name of its inventor. The last-named method of decoration is somewhat complicated. Ebony, or some dark wood, is generally the material upon which the inlaying is done. Where tortoise-shell is used, it is commonly laid upon a red ground, which shows through the transparent part of the shell. Brass patterns are let into a ground of tortoise-shell, and sometimes tortoise-shell is inlaid with the brass. Marquetry was formerly confined chiefly to black and white, but now a great variety of colors are used, and very complicated patterns and designs are produced. The art is very ancient.

(2773) Translation of a French Sentence.—Without seeing a cut of the machine described, or enough of the description to judge from the context, the exact technical meaning of the phrase is difficult to give, since technical terms in foreign languages are quite as arbitrary as they are in English, and especially is this the case with mechanical terms. We can, therefore, only guess at the meaning of the above phrase by judging from the general construction of grain cleaners what it should to be. Many grain cleaners have a cylinder of wire cloth, through which the dirt is delivered, either by a series of revolving brushes or its equivalent. In some cases the inner surface of the strainer is provided with a number of projections or steps, to prevent the grain from falling through too rapidly. We think that the above phrase refers to such a construction, and would translate it, "A strainer carrying all the steps," (or projections); or liberally, "A number of steps (or projections) is provided upon the strainer." This translation, as above said, will not do to swear by. If our correspondent will send us a cut of the machine, we will be able to verify it.

(2774) Pasteur on Vinegar-Making.—The article referred to in our December number, by Prof. Wurm, of Breslau, was published in *Dingler's Polytechnisches Journal*, Vol. 235, pages 225, *et seq.*, (1880.) The journal in question will doubtless be found on file on any large public library, as it is one of the leading technical journals. If our correspondent finds it inconvenient to visit the city for this purpose, he will be able to obtain the copy in question by sending an order to any reputable book-seller or publisher. So far as we know, there is no agency for its sale in this country, and it would therefore have to be imported by special order. An earlier communication by Pasteur on the same subject appeared in the same journal, Vol. 165, page 303, (1862); and a work by Pasteur, entitled "*Etudes sur le Vinaigre*," was published in France in 1868.

(2775) Importation of Polishing Powders.—We have submitted this inquirer's question to the Chief of the Bureau of Statistics, and have received by courtesy of the head of the bureau the following reply, which, as D. B. S. will perceive, is official:

Treasury Department, Bureau of Statistics,
Washington, January 22, 1881.

Dear Sir: In reply to your request of the 18th inst., I have to inform you that the value of tripoli and rotten stone imported and entered for consumption in the United States during the last three fiscal years, was as follows:

1878	$1,396
1879	3,330
1880	8,640

Rotten stone and tripoli seem to be different names for the same article. Very respectfully,

Joseph Nimmo, Jr., Chief of Bureau.

(2776) Estimate for a Bridge.—We have replied to this correspondent by letter, giving him the addresses of a number of bridge companies, with whom we have advised him to open correspondence for the purpose of getting estimates for such a bridge as he requires.

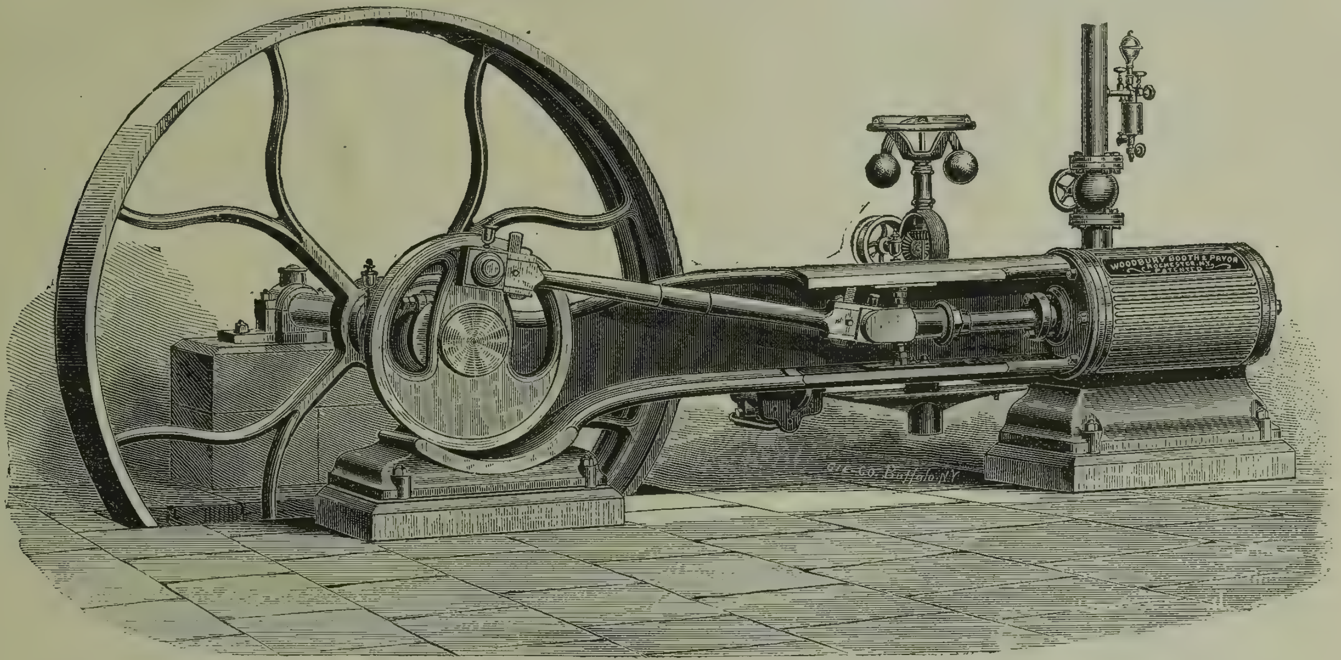
THE MANUFACTURER AND BUILDER,

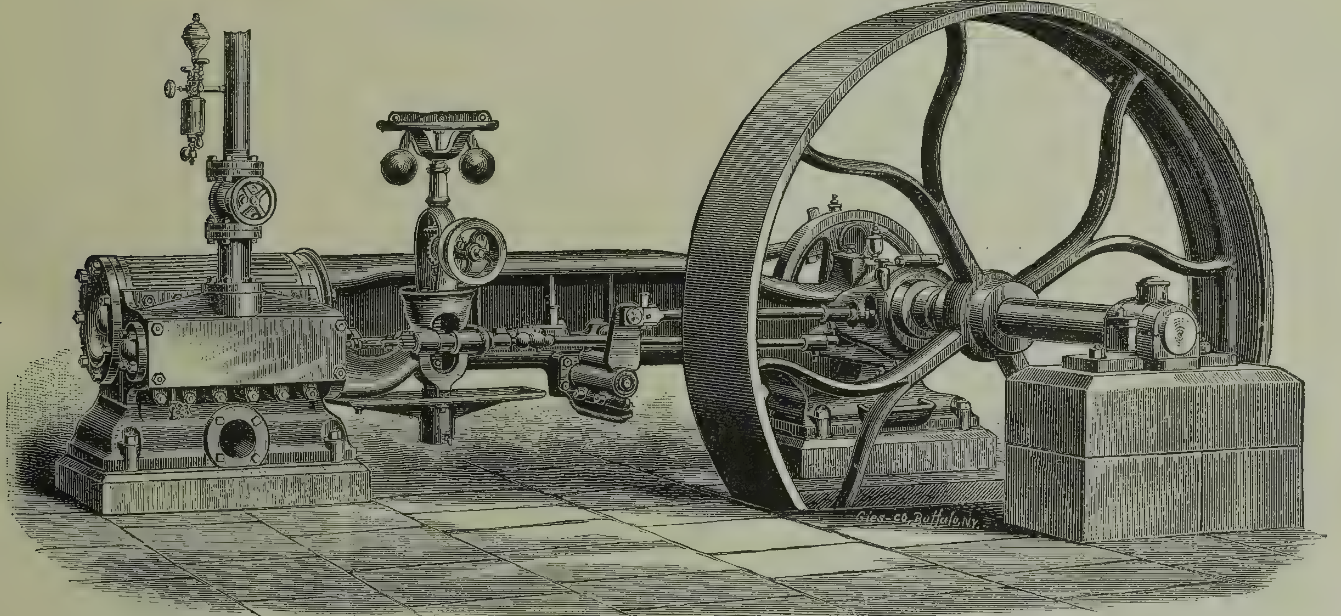
Vol. XIII.—No. 3. MARCH, 1881. THIRTEENTH YEAR.

Improved Automatic Cut-Off Engine.

Referring on previous occasions to the high economy realized in steam engine practice by using steam expansively, we have more than once observed that in the application of this principle, as of every other in mechanics, the most satisfactory results in the long run are realized in the use of the simplest constructions, wherein the liability to derangement is reduced to a minimum; and that where mechanical devices of this character were encumbered with a multiplicity of complicated details, requiring great delicacy of adjustment to develop their full benefits, the amount of attention they demand, and the losses incident upon stoppages for repairs, were sometimes sufficient to counterbalance their advantages.

While these criticisms are just as respects some forms of automatic cut-off mechanism, they serve to bring into stronger and meritorious prominence, others in which the severe requirements of practice are satisfactorily met. In this latter category we may class the improved automatic cut-off engine built by Messrs. Woodbury, Booth & Pryor, of Rochester, N. Y., of which we give the accompanying excellent engravings. These engines embody in their design and construction the results of many years of practical experience in engine building, and of close observation of practical needs, applied to the improvement of the steam engine, and they fully justify the claims of the makers, of realizing the greatest economy consistent with that degree of simplicity required in machinery designed for general use, which must necessarily be capable of being managed by those of ordinary skill and with ordinary care.





WOODBURY, BOOTH & PRYOR'S AUTOMATIC CUT-OFF ENGINE.

In these automatic cut-off engines, the distribution of the steam for both ends of the cylinder is effected by the use of a plain slide valve, cast in one piece, and driven by an ordinary eccentric, while the governing cut-off appliances are supplementary to this, operating

therefore independently of the main distribution. By adopting this system of construction, the makers avoid the serious objection to which many of the automatic engines are liable—namely, that in the event of a derangement or leak of one of the cut-off valves, the steam is permitted to pass directly through the cylinder, escaping through the exhaust valve, without accomplishing anything save to counteract a certain portion of the useful effect of the steam on the other side of the piston. Where balanced valves are used, the difficulty from this source is intensified, and what makes it specially troublesome is the fact that this element of waste is exceedingly difficult to detect.

In the system adopted with the automatic engines here described, it is obvious that there is no more liability to derangement and leakage than in an ordinary slide-valve engine, and should the cut-off mechanism by any mischance become deranged or leaky, none of the steam passing it would be wasted, but all would go to produce useful effect in the engine—an advantage which the independence of the valve mechanism from the operating mechanism of the cut-off fully assures.

Without sectional views, it will be unnecessary for us to do more than give a brief description of the valve mechanism of these engines, a general idea of which will be obtained from the following: The main valve is driven by an eccentric upon the main shaft through the intervention of a rocker-arm, and the cut-off valve by an independent eccentric. The cut-off eccentric rod connects with the slide working in the bracket by means of a ball-and-socket joint, which permits the valve to rotate in its seat, more or less, according to the load put upon the engine, and the steam pressure. This rotation, which never exceeds one-fourth of a revolution of the valve, is effected by a segment on the cut-off slide valve working into a rack attached to the governor spindle, which places the cut-off at all times under complete control of the governor. The cut-off valve works in a small cylinder attached to the back of the main valve, and cast with it in the same piece. The valve is a cylindrical one, having ports directly opposite, and therefore perfectly balanced. It has diagonal admission edges, with ports to correspond, so that by turning or rolling slightly in its seat, it is made to cut off sooner or later, as the case requires, the range being from zero to three-quarters stroke. The makers call special attention to the extreme simplicity of the valve mechanism of their engines. There are but two valves, each consisting of one single piece of casting, and these, with the rod attachments, constitute all the parts of the valve works inside the steam chest; all other parts connected with the valves and valve gearing being outside, and readily accessible. The governor is extremely sensitive, having by its special construction a large range of movement within a small variation in speed.

The close governing of these engines, which is one of their meritorious features, may be explained partly by the peculiar construction of the governor itself and partly by the fact that it has comparatively no work to do, the mere rolling of the balanced cut-off valve while sliding in its seat requiring but a trifling amount of force. The business relegated to the governor is, therefore, simply to regulate the speed, without being hampered with a heavy cut-off valve working under boiler pressure, or with any other resistance. The practical result of these features of construction is the attainment of great uniformity of speed and steadiness of motion throughout the range of their power and under the most sudden changes of load.

The makers claim for their cut-off mechanism the following advantages to an eminent degree: Simplicity of construction, and non-liability to derangement of parts. Positive and certain motion, it having no trip (or catch-and-let-go) movement whatever. Freedom from violent shocks of every kind, enabling it to be worked at any required speed, as well as an ordinary slide valve. Cutting off the steam sharply when the requisite point is reached (owing to its long and rapid travel), and lapping well beyond the edges of the ports. Constant uniformity of speed, immediate provision being made by the governor for the most sudden change of load, and the movement of the valve not having the slightest tendency to move the governor arms from their natural position due to the speed. As a result of the above advantages, there is secured in these engines a high degree of economy, which, combined with their simplicity and recognized durability, make them rank at once among the most efficient and desirable engines in the market."

The excellent engravings shown on the preceding page, give a very good idea of the appearance of this engine. The frame is simple and very strong, the form being such as to secure the greatest strength from the amount of metal used. It is substantially the same as has been used for many years for the Corliss and other engines of that class, but is made stronger in proportion. The holding-down bolts are arranged to come all in line, like a common "box" frame. It is also so constructed as to catch and collect the drip of oil and water, which would otherwise run down upon the foundations and floor. The fixed parts have the weight and form necessary to insure strength and stiffness, and the movable parts also have these essential qualities. At the same time, by the free use of steel and composition metals of the best qualities, a consistent lightness has been secured, and all joints and wearing surfaces have been well proportioned, and are easy of access. Everything is made in the most substantial manner, and accurately fitted.

With the economical advantages of engines of this class our mechanical readers are already familiar from previous articles that have appeared, and to recapitulate them in this place will be unnecessary. It will suffice to say in conclusion, that the makers of the engine here described have intelligently studied the theoretical and practical requirements of their subject, and that their engines embody in their construction and action the most advanced ideas respecting economy in the use of steam. We refer our readers to the manufacturers for further particulars.

The Steel Rail Controversy.

The late meeting of the American Institute of Mining Engineers, which was largely and influentially attended, was probably the most important meeting ever held by that active and useful organization. The subject that played the most prominent part at the meeting was that of the wearing qualities of steel rails, a subject of vital importance to steel manufacturers and to the railroad interests of the country. This question was brought up at the previous meeting of the society by Dr. Dudley, the chemist of the Pennsylvania Railroad Company. This gentleman, furnished with all the facilities which the great corporation just named could furnish to make a thorough study of this subject, made an elaborate investigation of the subject from a chemical standpoint, with a view of ascertaining the influence of the chemical composition of steel upon its physical properties, to establish a formula for the guidance of steel manufacturers. Without going into the technical details of the paper, we will simply state that, contrary to what might have been expected, Dr. Dudley reached the conclusion from a careful chemical examination of rails in the service of the railroad in question, that those showing the best wearing qualities, were made of comparatively soft steel. The conclusion arrived at by Dr. Dudley attracted much attention at the meeting at which they were first presented, and they were esteemed to be of such importance that the paper was made the subject of special discussion at the meeting just held. In the interval between the meetings Dr. Dudley continued and extended his investigations, and was justified by additional facts in support of his first conclusions.

The expected discussion of this important subject attracted to the meeting many of the leading steel manufacturers of the country, many of whom took an active part in the warm debate that followed.

Opinions seemed to be nearly equally divided in favor of, and opposed to, Dr. Dudley's conclusions; and the result will doubtless be a far more searching investigation of this important subject than it has ever before received.

The Manufacturer and Builder.

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Vol. XIII. No. 3. THIRTEENTH YEAR.

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(Illustrated articles are indicated by an asterisk (*).

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Toronto News Co., Clifton, Ontario, Canada.

Extra Edition of May Number.

We desire to announce an issue of 10,000 extra copies of the May number of the MANUFACTURER AND BUILDER for gratuitous distribution among the MANUFACTURING and BUILDING interests of the country. The addresses to which this special number will be sent have been very carefully compiled and comprise all the prominent manufacturers, machinists and builders in the United States, not already reached by our regular circulation. This large extra issue in addition to the latter will offer one of the most valuable opportunities that could be afforded advertisers for reaching the special lines of trade to which the number will be devoted. We trust that our efforts to serve the industrial community will be recognized by their liberal support, and we shall be pleased to furnish estimates for space or give any further information desired on application.

Underground Telegraphy.

The question of securing the immunity of lines of telegraph from the periodical interruption of communication from storms and other causes, which we treated very fully in our last issue, has since been the subject of much discussion in the newspapers. In this discussion the scientific portion of the press has participated, though not to the extent that the importance of the subject would seem to justify.

One communication in the London *Times*, from the pen of Mr. C. W. Siemens, will specially interest our readers. This gentleman, an eminent savant, and a leading constructer of telegraph lines, referring in his communication to the interruptions of electrical communication by storms and accidents, states that the German government, though it had failed in a previous effort (in 1846) to lay underground wires, decided about five years ago to try again, and met with such success, that after having laid 8,000 miles of underground lines, it has determined upon the further extension of the system. Mr. Siemens says that though part of these wires have been down for five years, the expenditure for maintenance has thus far been nothing; nor is it probable, he adds, that any repairs will be needed for years to come.

The French government, it appears, has been impressed with the success attending the operation of these German land lines, and it is reported that the French Chambers have lately voted a grant of several millions of francs for the construction of an underground system to connect the principal cities of France with Paris.

One of our leading scientific contemporaries, in its comments on the subject of securing immunity against interruptions of telegraphic communication, while hesitating apparently to admit the feasibility of putting under ground a large portion of the wires, thinks that the enactment of a law requiring that all wires shall be so placed, would be a great hardship to the owners of innumerable private telegraph and telephone lines, and would, in the case of such lines, which the exigencies of business in our great cities have made indispensable, be little less than prohibitory. It urges, further, that the frequent upturning of streets for the extension of such lines, were it otherwise practicable to bury them, would prove to be a nuisance, quite as great as the poles for the support of the present air lines. The opinion is finally expressed that the difficulties complained of could be remedied by improving the modes of supporting and distributing the existing lines, and it is suggested that the granting of privileges to public and private companies to use the roofs of houses, under certain restrictions, etc., would meet the difficulties of the case in the most practical way.

In answer to these objections, we have simply to say that the unwillingness of our contemporary to admit the feasibility of underground telegraphy is quite inexplicable, in view of the complete demonstration of the success of the system in Germany and other countries of Europe, not only for lines in cities, but for extensive land lines. The facts relating to the adoption of the underground system abroad are matters of public knowledge. There is nothing secret or mysterious about them, and they cannot be overlooked or ignored in an impartial discussion of the comparative merits of the underground system.

Respecting the remedy suggested by our contemporary of improving the modes of supporting and distributing the existing lines by using the roofs of houses; while this might do away with the disfigurement of the streets of our cities by the unsightly poles now in use, it fails to meet the great objection of the constant liability of aerial lines to interruption of communication from the breakage of supports and wires by storms, accidents, or otherwise, which would be quite as great whether the lines were strung upon posts planted in the streets or upon supports planted on the roofs of the houses. Again, while the value and necessity of the telegraphic service is universally admitted, it is a question whether the general public would not decidedly prefer to put up with the nuisance of the poles in the streets rather than clothe the irresponsible agents of telegraph companies with legal privileges to enter their houses at their pleasure to erect or repair their lines.

Our argument in favor of the compulsory adoption of underground lines was directed primarily against the telegraphic corporations, and chiefly against the obnoxious monopoly which controls the greater portion of the telegraphic business of the country, and to whose posts and wires the bulk of the obstructions and disfigurement of our city highways is due; and while we will admit that the compulsory adoption of the underground system would temporarily prove a serious inconvenience to the owners of private lines, we fail to see the force of such an argument in favor of the maintenance of the present system, which the vast majority of the public agree in denouncing as a nuisance. Where the convenience of individual citizens conflicts with the convenience of the general public, the former must make way.

As to the objection that the frequent upturning of the streets would be quite as great a nuisance as the evils of the present system, it may be well to remind our contemporary that the streets are very frequently upturned as it is, for repairing or making connections with the gas and water pipes, for laying or repairing sewers, mending streets and the like, and a little more or less of that sort of thing would hardly be noticed. It would be a comparatively easy matter to lay at once many more wires than are required for present use, which could be called into requisition and properly connected when required. Hollow curbs could be used in which to lay the wires, without the slightest inconvenience on this score, and many other devices to the same end would no doubt come into use should there be any occasion for them.

There is nothing in the objections advanced against the adoption of the underground system of telegraphy, and the fact that the existing nuisance of poles and overhead wires is tolerated, and even finds supporters, is another illustration, of the many that could be named, of the unaccountable willingness with which the average American citizen allows himself to be kicked, cuffed, pilfered and generally abused by soulless corporations.

Work of the U. S. Patent Office.

While neither the publisher nor editor of this journal is in any wise interested in the business of soliciting and taking out patents, they take a lively interest in everything that relates to the administration of the Patent Office, and in anything that promises to enhance its usefulness and promote its efficiency, because of their conviction that the liberal patent system of this country has shown itself to be of immense service to all classes, in fostering and encouraging native ingenuity, and in aiding the progress of the useful arts.

Few persons have an idea of the magnitude of the work yearly performed by this important branch of the Government service, and as we wish to make some comments bearing upon the greater efficiency of its administration, we present the following condensed statement of the business of the office for the past year from the annual report of the Commissioner. From this it appears that the business transacted by the office was as follows:

Applications for patents, for inventions, 21,761; applications for patents for designs, 634; applications for reissue, of patents, 617; total, 23,012. Patents issued, 14,441; patents reissued, 506; patents expired, 3,781; trademarks and registered, 533. Of the 13,441 patents issued during the year, 11,655 were to citizens of the United States and 786 to foreigners.

There was received during the year for patents, copies of records or drawings, and from other sources, an aggregate of $748,695.32. The total amount expended was $538,865 17, leaving a balance of $210,-820.15. On January 1, 1880, there remained $1,420,-806.56 to the credit of the Patent Fund which added to the surplus of 1880, makes the amount to the credit of the Patent Fund on January 1, 1881, $1,631,626.71.

From these figures it is seen that the Patent Office is one of the few branches of Government service that is self-supporting; but of this more anon.

We are specially interested here in a matter, which the present Commissioner very clearly sets forth in his report, namely the urgent necessity of an increase in the official staff of the Patent Office. Commissioner Marble calls special attention to the fact which has long been one of the standing grievances of all who have business with the Patent Office, that the force of the department is by no means adequate for the proper and expeditious performance of its business. The simple statement of the number of applications for patents and of the number granted gives but the vaguest idea of the actual extent of the work accomplished by the department. It should be remembered that the theory upon which our patent system has been founded requires that the applicant for letters-patent shall demonstrate originality and priority in his invention. These features can only be established after critical investigation and a faithful search through the voluminous records of the patent offices of this and other countries. It is apparent that the purpose of the framers of our patent system was that the issue of letters-patent to an inventor should of itself be *prima facie* evidence that his claims to originality and priority have been thoroughly examined and approved. And it follows as a matter of course that anything which lowers the high standard of thoroughness, which should be maintained, in the preliminary investigation of the claims of applicants, lowers public confidence in the value of patent rights. This state of public opinion entails serious injustice and injury upon inventors and purchasers of patent rights. By undermining the soundness of the title to property in patents, it renders more difficult the task of the inventor to find a purchaser for his invention; it encourages infringement upon patent rights, and thus invites the litigation, which it was the original intention our of patent laws to avoid; and it renders capital timid of this form of investment.

Unfortunately the above is a tolerably truthful picture of the state of things in this country to-day respecting property in patents; and Commissioner Marble, fully alive to the evils that have grown up, points out the true remedy, and seeks for authority to apply it.

His report shows that the force of the department is insufficient to properly execute its vast business. In spite of all the expedition that can be made in dispatching business a number of the departments are months behind hand with their work; and to show how inadequately the statistical statement of patents issued represents the work of the office, he points out the fact that numerous amendments are necessarily made in the applications, before they are finally granted, and that as many as 92,000 decisions were made in matters pertaining to the applications made during 1880. The Commissioner asks for authority to add to his present force, one principal examiner, three first, three second, and three third assistant examiners, as a matter of urgent necessity.

There can be only one opinon respecting the pro-

priety of this request. It should be granted at once. The Patent Office is not a burden upon the Government, but as the figures we published above, show, is more than self-supporting. Nothing that the Government can do to promote the efficiency of the Patent Office, and to perfect its administration should be left undone.

Chamber's Improved Brick Machine.

This simple and ingenious machine, of which we present herewith a perspective view, has acquired an extended reputation under the name of Chambers' "B" Brick Machine. It belongs to the general division of "die" machines, as distinguished from "mold" machines, the former comprising such machines as form, by means of a die, or its equivalent, a continuous bar or slab of the clay or other plastic material operated upon, which is subsequently cut into blocks of proper lengths to form the brick. The "mold" machines, on the other hand, form each brick in a separate mold. The machine about to be described tempers its own clay with water, taking the clay as it comes from the bank, without any previous handling or preparation, and forms it into bricks, with sharp, well-defined corners and smooth, straight surfaces, at the rate of from 50 to 80 per minute, or from 25,000 to 35,000 per day of ten hours.

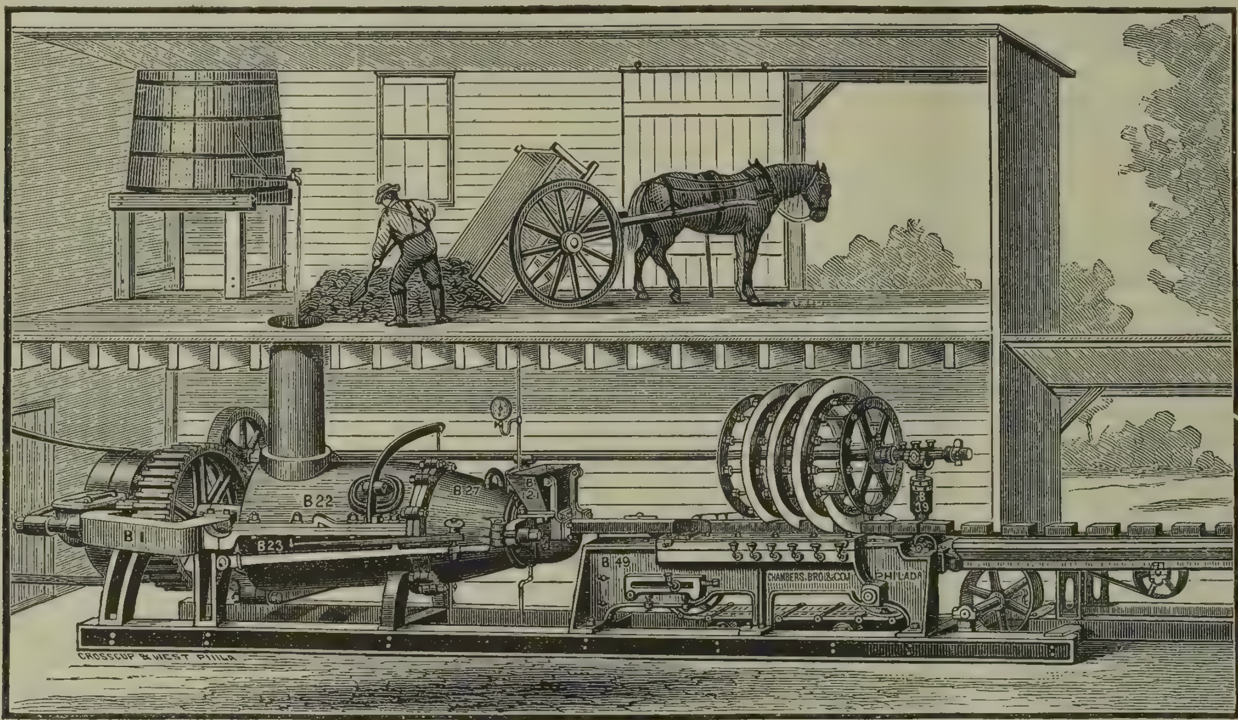


Fig. 1.—PERSPECTIVE VIEW OF THE CHAMBERS "B" BRICK MACHINE.

The essential parts of the Chambers "B" brick machine, are, the tempering mill, the impelling screw, the forming die, and the cutters. Their construction and operation will appear from the following description: A longitudinal section through the case of the machine is shown in Fig. 2, giving at a glance the disposition of the knives upon the shaft, the impelling screw, and the die. Fig. 3 is a transverse section, showing the disposition of the knives and the direction of their motion; while Figs. 4, 5, 6 and 7 show the several details relating to the forming die. The tempering mill is contained in the cylindrical portion of the machine, and consists of a strong iron case, in which revolves a horizontal shaft. To this shaft are attached a number of strong tempering knives, consisting of a series of blades of steel set spirally, the object of this arrangement being, that as they pass through the clay they shall at the same time move it forward towards the impelling screw. The clay is fed into the tempering portion of the machine through the hopper shown in the cut, and which, to avoid packing or clogging, is made somewhat larger at the bottom than at the top. The condition of the clay as fed into the tempering mill, as regards moisture, should of course be such as to leave it stiff, so that it shall not slip before the knives, but be cut through and through and thoroughly mixed. When it reaches the impelling screw, therefore, it will be ready to be formed into bricks.

The second portion of the machine is the screw, which is contained in the conical portion of the iron case. The interior of this portion of the case is ribbed, with the object of preventing the clay from revolving in it, and is chilled to prevent wearing. Upon the smooth surface of this screw the tempered clay is impelled forward and forced in a continuous bar through the third portion of the machine—the forming die, which has an orifice corresponding to the transverse section of a brick.

As the clay issues from the orifice of the die, it is carried forward by a plate to the cutting device. This consists of a thin blade of steel, in the form of a spiral, the distance between the threads of the spiral being the exact length of a brick. This spiral knife runs perpendicularly in a flat endless chain, which supports the bar of clay at one edge and at the bottom, by which arrangement a smooth, square cut is insured, the equality of pitch in the spiral insuring equality of length in the bricks. An ingenious governor and frictional device is provided, by which the speed of the spiral cutter is made to depend on the speed of the issuing bar of clay, which will vary slightly, according to its stiffness. By these devices, the speed of the knives is directly proportioned to the speed of the issuing bar. To provide against the cutters being affected by the presence of stones in the clay, the wheel to which they are secured is held in position by means of gravity, which holds it with just sufficient force to compel it to pass through the bar of clay. Should the knife meet with any extra resistance, such as would be caused by the presence of stones, sticks, and the like, the weight yields and allows the knife to move up, and thus cuts around it, the knife immediately falling back to its original position, ready to cut through the bar further on. The bricks thus cut from the continuous bar are then separated and carried by an endless belt any distance convenient for off-bearing on cars or barrows. The bar is sanded with fine sand, which, adhering to the moist surface of the bricks, renders them better fitted for handling, and prevents them from sticking together on the barrows or in the hacks. In the machines at present build the dusting chamber is placed in the end of the case, directly in front of the die.

To secure sharp and hard edges to the issuing bar, and to the bricks made from it, Mr. Chambers has introduced an ingenious modification in his forming die, which he makes with a varying cross section, giving it a peculiar enlargement at the corners at its commencement. Having thus placed an excess of clay at the corners, the gradual contraction of the die results in packing the clay hardest in the corners, and brings the bar out with the desired hard and sharp edges.

Should a stone or other obstruction too large to pass through the screw find its way to it, the flow of clay will be forced to issue at the safety valve provided for the purpose, and thus make known the presence of the obstruction, which may be removed. A smaller obstruction lodging in the die, will show itself by splitting the issuing bar of clay, and may be at once removed by swinging open the die, which is hinged to the case for this purpose.

The makers of this machine have overlooked nothing in their efforts to perfect it. It is because of their attention to many practical and seemingly unimportant details that much of the substantial success they have achieved must be ascribed. For example, all the main moving parts have their journals in one solid casting. The whole machine is self-contained—that is, all complete within itself. It cannot settle out of line; all wearing parts are easily removed. Each casting has a letter and number cast upon it, indicating the size of the machine and the particular piece. They are all fitted to standard gauges, so that by sending the letter and number, any piece can be duplicated at once, and fit guaranteed. The machine is replete with little conveniences and requirements for its easy care and durability. Each oil cup has a self-closing lid, so that it cannot carelessly be left open. Each journal has a dirt-band over it, to prevent the dirt from working into it, and many of them are entirely closed at one end for protection.

It is attention to such matters as these, which many makers of really excellent machines frequently overlook, that often makes the difference between success and failure. The manufacturers of this brick machine are so well satisfied with its merits that they announce the standing offer to sell to any responsible brickmaker in the United States "subject to trial and approval."

For any further information desired, address Chambers, Brother & Co., Philadelphia, Pa.

Glass Manufacturing in America.—It is said that there are 89 flint glass factories in the United States, in which are 1,418 pots, consuming 2,324,608 tons of material in the year, and producing 2,062,148 tons of

flint glass. There are 60 establishments, containing 694 pots, engaged in manufacturing window glass, the average product of which is 2,644,440 boxes of 50 feet single thickness each. The number of green glass and bottle manufactories is 51, with 724 pots. There are six plate glass works, containing 134 pots.

Draining the Everglades.

An enterprise of considerable importance, involving the reclamation of an immense tract of swamp land in Florida, at present utterly valueless, is about to be undertaken, if report may be relied on. The magnitude of this undertaking will be best understood from the statement, that the practical result of the completed work will be the reclamation for agricultural purposes of not less than 12,000,000 acres of land, which is represented to be of boundless fertility.

The region in which this improvement is projected is the vast and almost unpenetrable swamp set down on the maps as the "Everglades," made memorable in American history by the frightful massacre of Major Dade and his hundred soldiers by the Seminoles, who lured the unfortunate commander and his men into the dark recesses of the swamp into an ambush, and to death. The region has never been fully explored, and all that is known of it is that it is a great swamp, containing a number of lakes, with islands here and there, supporting a vegetation of tropical luxuriance. The few inhabitants of the region who live upon its outskirts are represented as being a mongrel race of white, Indian, and Negro blood, who manage to exist in a state of barbarism. They are the degenerated descendants of the early masters of the soil, who retired into the fastnesses of the swamps before the invading armies of the Government.

The wonderful fertility of the soil of this region had long ago suggested to practical minds the desirability of reclaiming it to agriculture, and competent engineers having pronounced the work to be feasible, it has waited for the necessary combination of energy and capital to be undertaken.

The present report is to the effect that a company composed of Philadelphia and Florida capitalists, under a liberal contract with the State of Florida, has been formed to undertake the great enterprise. The conditions of the agreement made with the State, it is said, require the company to begin surveys within 60 days, and within six months to put a force of 100 men at work and to continue the work until the land is reclaimed. It is proposed to drain the land by a canal from Lake Okeechobee to the Caloosahatchee River, which empties into the Gulf of Mexico. Another canal may also be constructed to the East, tapping the St. Lucie River, which flows into the Atlantic. These canals will entirely drain the swamp, and from 10,000,000 to 12,000,000 acres of the richest land in the world will be reclaimed. The company will receive for the work one-half of the land recovered, and it is expected that this will amply repay all expenditure of money which may be made in the work.

If this remarkable enterprise is undertaken, as report has it, and carried to a successful conclusion, it will prove to be by far the greatest work of the kind ever consummated, in the magnitude of its results. The drainage of Haarlem Lake in Holland, and of Lake Fucino in the Roman Campagna, and even the projected drainage of the Zuyder Zee in respect to the extent and probable value of the land reclaimed, sink into comparative insignificance beside it.

A Steam Boiler Explosion.

The Keystone Council of Stationary Engineers, of Philadelphia, in the case of a boiler which exploded at Allentown on the 6th of January, after summarizing the evidence, says: In the first place we find malconstruction; the boiler hung at the extreme ends, with no support for the center, and the hole in the shell being cut out the full size of the dome, which tends to weaken the shell of this diameter very much, and the fourth sheet being five-sixteenths thick, and the fifth sheet three-eighths thick, while all the sheets should have been the same thickness. The one sheet being heavier than the other, the heavier sheet tends to pull the lighter sheet apart, from the difference of their expanding qualities. We find bad workmanship in the riveting, the holes not being even, and the rivets too small for the holes—the holes being three-quarters

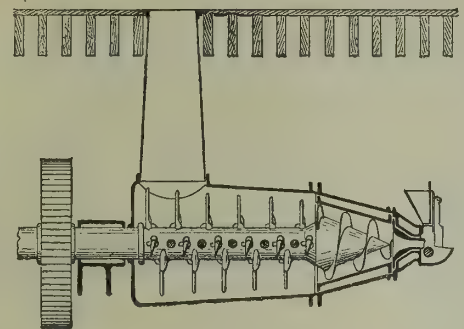


Fig. 2.—Longitudinal Section.

of an inch and the rivets five-eighths—and from the evidence, the pressure has been carried far in excess of a safe working pressure for a boiler of this size and thickness. As we estimate the strength of a boiler by its weakest part, we would judge the character of the iron as it presents itself to be able to sustain a tensile strength of 52,000 pounds per square inch, and reduced 44 per cent for single riveting, and the thickness being

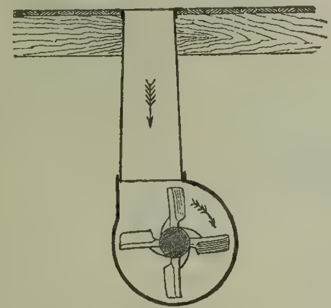
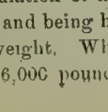


Fig. 3.—Transverse Section.

five-sixteenths—the boiler being 36 inches in diameter —the bursting pressure would be 505 pounds, and one-sixth of the bursting being the safe working pressure (by our city ordinance), the safe working pressure would be 84 pounds. This would be the safe working pressure of the rim that gave way, the fourth sheet;

Fig. 4. *Fig. 5.*



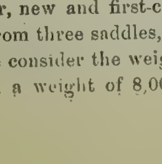


Fig. 6. *Fig. 7.*

Details Relating to Forming-Die.

while the fifth sheet, being three-eighths by the same rule, would give a bursting pressure of 606 pounds and a safe working pressure of 101 pounds. This would be a calculation of a boiler, new and first-class workmanship, and being hung from three saddles, distributing the weight. When we consider the weight of the boiler at 6,000 pounds and a weight of 8,000 pounds water and 5,000 pounds of bricks and mortar laid on top of the boiler, there is not much wonder why it gave way in the center, particularly by the assistance of at least 90 pounds per square inch on the heads, which would be the mean between 60 and 120 pounds, which would be equal to a force of 91,608 pounds pressure on the heads, tending to pull the boiler apart in its curvilineal seams, while the curvilineal seam in its full strength, admitting it to be equal to 52,000 pounds per square inch, and reducing it 44 per cent for riveting and it being 113 inches in circumference, its tensile strength would be 1,028,300 pounds, and one-sixth of this being a safe load for it to bear, would be 171 386 pounds, and substracting 91,608 pounds, which would be the pressure of steam exerted on the head by a pressure of 90 pounds, would leave us 79,778 pounds as a surplus to support the weight of the boiler; weight of water and weight of bricks and mortar would be 19,000 pounds. There is not much wonder that the boiler gave way in the center, which, theoretically and practically, is the weakest point, when hung from the ends and no support for the center. The boiler should undoubtedly have been condemned before the last patch was put on; the boiler is evidently a great deal older than six years.

Paper Car Wheels.

The paper is straw-board of rather fine texture. It is received in the ordinary broad sheets, differing in no particular from those used for straw-board boxes or other similar work. These sheets as they come from the paper mill are square, and must first of all be cut to a circular pattern. This is rapidly done on a large table with a knife that is guided by a radial arm that swings freely over the surface of the table from a pivot at the center. A small disk is also cut from the center of the sheet to allow for the iron hub. Being thus reduced to the required shape and dimensions, the paper must now be converted from a mass of loose sheets into a compact, dense body, capable of withstanding the tremendous crushing force to which it will be subjected in the wheels. This is accomplished in the following manner: Ten sheets are pasted together, one upon the other, making a disk of about one-eighth of an inch thick. Enough of these disks having been prepared to fill a powerful hydraulic press, they are subjected to a pressure of 1,880 pounds to the square inch. When removed the disks are hung on poles in a steam-heated loft and left six days to dry. Thicker disks are then made, each formed by pasting together two or three of those already finished. These are pressed and dried as before, and the process is repeated until a block is built four inches thick and of about the specific gravity of lignum vitæ. After each pasting and pressing six days are allowed for drying, and when the block is complete it is left in a drying room until thoroughly seasoned. The next operation is that of turning the paper blocks to fit the steel wires and iron hubs. This is done in lathes with as much accuracy and in exactly the same manner as if the material worked on was iron or wood. The circumference is turned to a perfect circle of the precise diameter required, a bed or recess is worked out for the web of the tire to rest in, and the edges sharply defined. The block is then painted and is ready for its place in the wheel.

The Suez Canal.—The number and tonnage of all the steamers which entered and cleared, via the canal, at all the Indian ports in 1879–80, was 1,067, of 1,609,-769 tons in the aggregate. While the number of vessels can hardly be said to be increasing, taking the average of the past five years their average capacity has increased. In 1875–76 the steamers averaged 1,433 tons each; in 1879–80, 1,507 tons each. Only vessels of great carrying capacity can profitably take the canal route, and pay the heavy dues levied yearly. Larger vessels specially built for this trade, are being placed on the lines now running regularly.

Sturtevant's Blowers and Exhaust Fans.

The centrifugal principle affords the readiest and most serviceable method of moving bodies of air and gases, and hence has come to be almost universally adopted for blowing and exhausting for a great variety of purposes in the industries. Much attention has been devoted by certain manufacturers to the improvement of machines for these purposes, the manufacture of which, chiefly through their efforts, has become a specialty of considerable importance.

Among those who have become widely and favorably known in this branch of manufacture, the name of Mr. B. F. Sturtevant, of Boston, will be familiar to most of our readers. Mr. Sturtevant has made this field his own for a number of years, and to him the industrial world is indebted for a number of substantial improvements in the construction of blowers and exhausters. From the great variety of special forms of blowers of this manufacture, we present for illustration the two shown herewith.

The importance of this class of machines will be best understood by an enumeration of the uses to which they are put. They are conveniently divided into a number of classes, according to their special adaptation. Pressure blowers are used for blowing cupolas and forges of all kinds for working iron, steel and other metals; also for blowing reverberatory, heating and puddling furnaces and nobbling fires; for steam boiler furnaces where fine coal is used, and especially where it is desired to utilize such waste products as screenings, spent tan, sawdust, and the like for fuel; for cooling the hot molds in glass manufacture, and other special uses too numerous to mention.

Exhaust fans are almost universally in use in wood-working establishments for carrying away shavings, chips, sawdust and the like from planing, molding and other wood-working and finishing machines; dust from emery and other polishing wheels; for removing smoke and gas generated in the smith-shop and in chemical and other manufacturing establishments; for removing steam and vapor from drying cylinders and rooms; for removing offensive odors where circumstances render it desirable in other cases; and, most important of all, for ventilating mines and underground spaces, and buildings of every description. For the last named purpose, machines of immense size and capacity have been built for use in the ventilation of large public buildings, and extended experience has shown that this is one of the most efficient methods of accomplishing this difficult task. Mr. Sturtevant's blowers are in use for this purpose in the Capitol at Washington, and in many of the large government buildings throughout the country.

Blowers and exhaust fans are fast coming into general use, in connection with steam heaters, for drying purposes—for drying cotton, wool, hemp, flax, and all other fibrous material, as well as textile fabrics of all kinds; lumber, grain, tobacco, leather, glue, pottery, brick, fertilizers, and anything else where hot wind can be used to advantage. This enumeration is by no means complete, but will serve our purpose in illustrating the extent, variety and importance of the uses of this interesting class of machines.

The illustrations represent two methods of communicating motion to the fans. In Fig. 1 motion is communicated from the engine by a belt over the pulley seen in the cut. Fig. 2 shows an improvement Mr. Sturtevant has recently introduced, by which the fan is driven directly by the steam, without the intervention of belt and pulley, and consequently with decided economy of power. Mr. Sturtevant's machines are in use in nearly all of the largest manufacturing establishments in the country. By addressing the manufacturer additional information may be obtained.

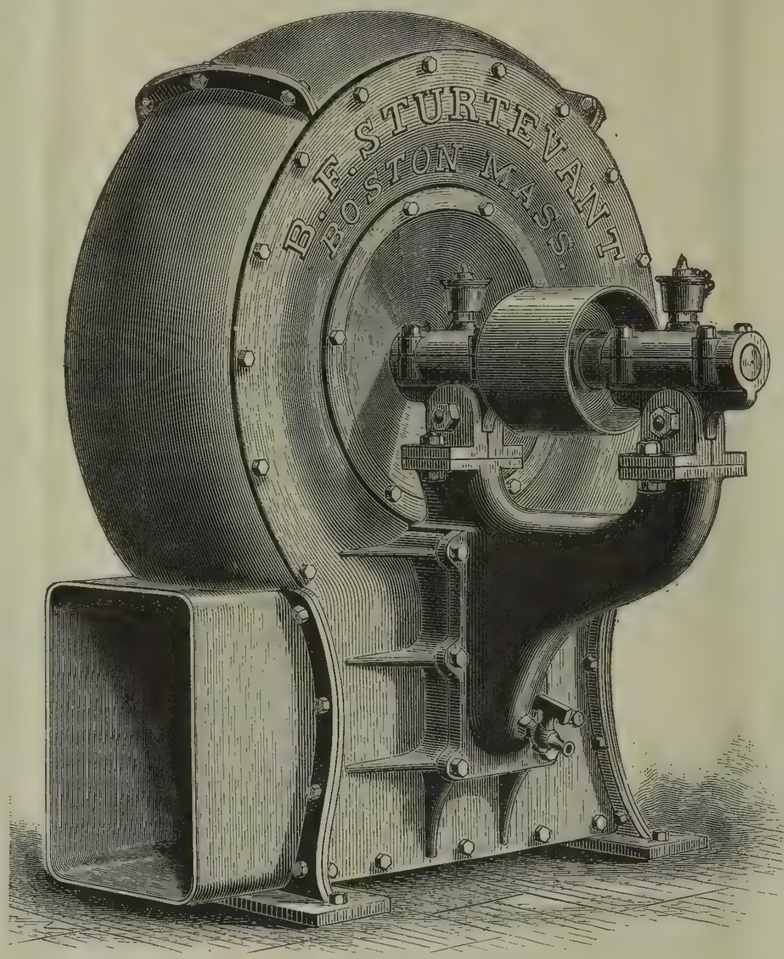


Fig. 1.—STURTEVANT'S EXHAUST FAN.

Fig. 2.—STURTEVANT'S STEAM FAN.

The Mightiest Lever in the World.

The colossal crane at Woolwich, which has been upwards of four years in process of erection, recently assumed a definite shape in the operation of fixing the great girder, and the character of perhaps the most powerful piece of mechanism in existence can now for the first time be understood at a glance. The girder radiates upon a central pile, with the outer extremity of the arm supported upon a wheeled tower, traveling on a circular railway which encloses about a quarter of an acre of ground. The extent of the work is further illustrated by the weight of the iron employed in its construction, which in the aggregate exceeds 1,800 tons, while the brass bearings alone amount to more than three tons. When completed, the crane will be capable of lifting three or four 100-ton guns at once; but the purpose for which it has been provided is not to do work which other appliances could accomplish in detail, but rather to meet the probable necessity for dealing with specimens of ordnance so enormous as to defy all the means at present available for mounting them on their carriages. The motive power will be steam, supplied from the adjacent boiler-house, and working a pair of cylinders suspended from the central crown and revolving with it, but inside a group of eight columns, which support the structure. Along the upper surface of the girder the lifting carriage travels, bearing below the lifting blocks, the whole of the gear being put in action and controlled by one man at the central cylinders. The girder traverses at a hight of 50 feet from the ground, and the carriage upon it makes the total hight 70 feet. It is 75 feet long from the center to the revolving power, which consists, like the central group, of iron pillars firmly bound together. The carriage upon which the tower rides is a double bogie truck, riding on rails 12 inches in breadth, with the ordinary gauge of 4 feet 8 inches. These rails run completely round the compass, making a circumference of about 430 feet, and the sweep can be made in either direction at a fair speed. Although calculated to raise 1,200 tons in case of need, the apparatus will also be fitted with a light gear for raising small weights at accelerated speed, and it is anticipated that even in the ordinary daily works of the Royal Gun Factories, to which department it belongs, it will prove a valuable auxiliary.

Acid in Lubricating Oils.

It is a well-known fact that the presence of a small quantity of fatty acid in oil renders it unfit for lubricating purposes, by reason of the rapid corrosive action it exerts upon metals with which it is brought into contact. It is of the greatest importance to be able to recognize the presence of acid in oils designed to be used for lubricating purposes, for the reason that irreparable injury may be done to delicate machinery by the use of such materials, before their character is discovered.

For this purpose, Dr. Wiederhoer proposes to employ the sub-oxide, or red oxide, of copper. If the latter cannot be conveniently had, the copper scale of the coppersmith will answer the purpose, as it contains the sub-oxide. Either of the substances named

may be taken, placed in a glass vessel or porcelain dish, and covered with the oil to be tested. If the latter contains the slightest trace of acid, it soon assumes a greenish color, the latter making its appearance first on the surface of the copper scales. In the cold it may take from a quarter to half an hour for the color to show itself; if heat is applied, it is hastened. The test is so simple that any novice can apply it without fear of error, and it is said to be very delicate. The absence of the coloration may be regarded as a certain indication that the oil is perfectly free of acid.

Improved Hydraulic Elevators.

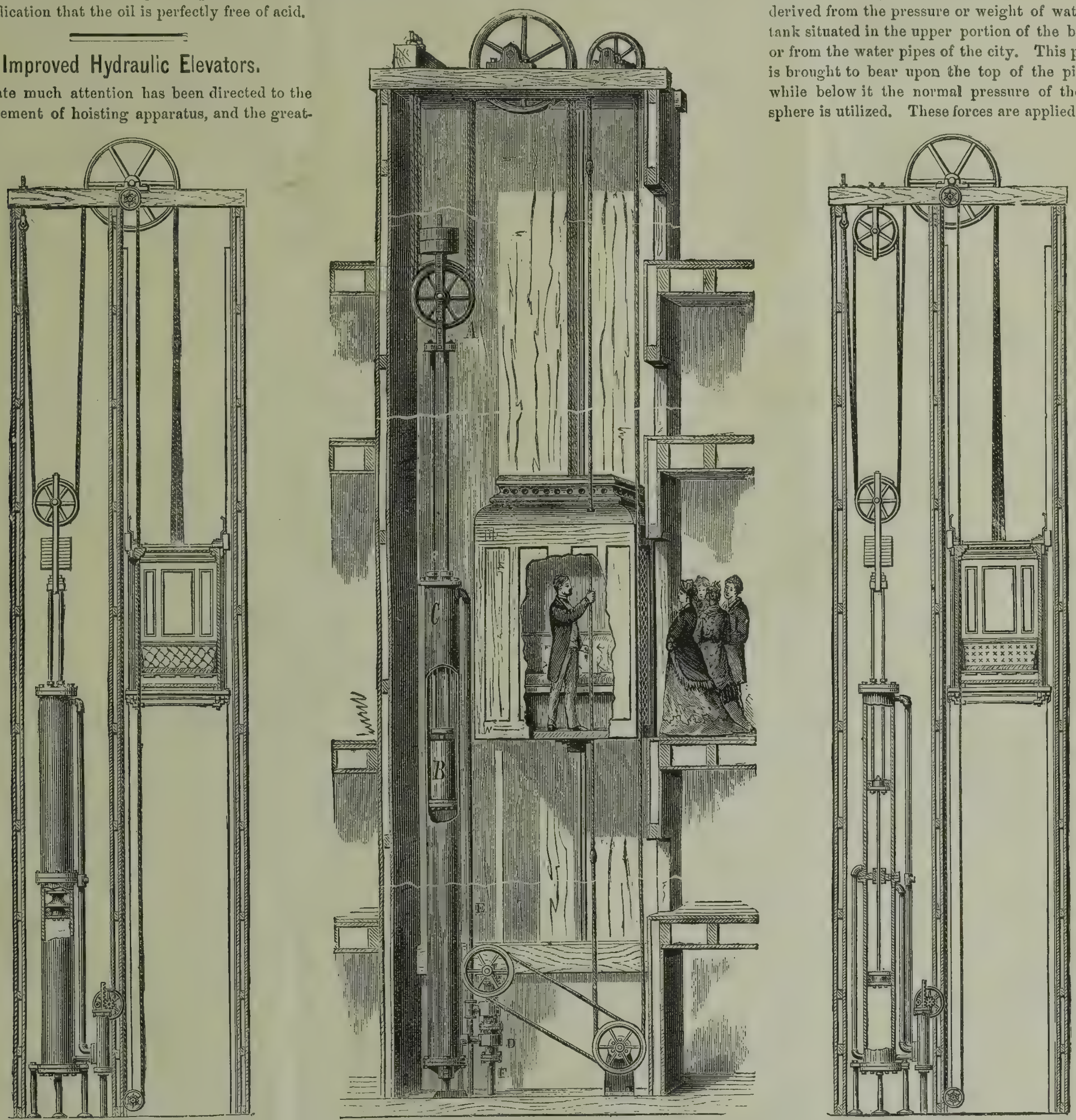
Of late much attention has been directed to the improvement of hoisting apparatus, and the greatest amount of skill and ingenuity has been expended in increasing their safety and convenience. Much of the improvement in the character of this class of machinery is directly traceable to the constantly increasing introduction of elevators for passenger service. For this purpose the elevator has become absolutely indispensable, and it is fair to infer that the increasing concentration of business in certain quarters of our cities, which is accompanied with an increase in the value of land, and a correspondingly increasing tendency skyward of business houses, hotels, etc., will cause an increasing demand for machinery which saves so much time and muscular effort, and which materially enhances the value of the upper stories of high buildings by making them as readily accessible as the lower ones.

The first passenger elevators were simply improvements on the freight cages, but their liability to accidents did not recommend them to public favor. Safety appliances in the form of extra supporting ropes, clutches, catches, etc., were provided in time, and by doing away with many of the objections to this class of machinery, fairly inaugurated the era of passenger elevators, until to-day a large building without an elevator is regarded quite as incomplete as though it lacked heating apparatus and similar indispensable conveniences.

An objection urged against the introduction of elevators, was the necessity of employing steam as the motive power, in the use of which it was impossible to avoid a certain amount of roughness of action. This objection, in turn, was happily overcome by the substitution of hydraulic power for steam, and in the improved hydraulic elevators generally in use to-day, we have an apparatus which very fully meets the public requirement of a smoothly operating and safe means of ascent and descent.

Otis Brothers & Co., of 348 Broadway, New York, have devoted much time and attention to the perfection of the hydraulic elevator for freight and passenger service, and have succeeded in securing for their apparatus an excellent reputation for convenience, simplicity and safety. We illustrate in the accompanying engravings the hydraulic elevator for passenger service made by this firm, accompanied with a brief description of its details.

The motive power for running this elevator is derived from the pressure or weight of water in a tank situated in the upper portion of the building, or from the water pipes of the city. This pressure is brought to bear upon the top of the piston B, while below it the normal pressure of the atmosphere is utilized. These forces are applied to raising the car, the water being also drawn from the cylinder below the piston. The car is connected with the piston by a number of wire ropes which are passed up over a fixed pulley wheel, and thence to the traveling sheave A, and their standing parts are secured above, as shown in the cut. By a recent improvement, the counter-balance weights connected with the traveling sheave have been placed in the cylinder. The united weight of the sheave and the piston counterbalances that of the car. The piston is secured to the sheave, and works up and down in the cylinder C. When the piston reaches the upper extremity of the cylinder, the car is at the bottom of its route, and if the operator then desires to make the car ascend, he pulls the valve



OTIS BROTHERS HYDRAULIC PASSENGER ELEVATORS.

rope, which the cut shows him in the act of grasping; the valve D is then opened, which causes the water to enter the pipe E to the top of the piston, and at the same time F is also opened, which permits the water in the cylinder below the piston to escape. Our readers will observe that by discharging the water during the ascent of the car, the pressure of the atmosphere is utilized down to the level of the discharge, and thus the maximum of power is secured, while the water in the cylinder acts as a brake in lowering the car; and it is these features especially which give these machines a special advantage over others in the market.

The weight of the car is counterbalanced, as above mentioned, by that of the piston and sheave, and, therefore, the resistance to be overcome reduces itself to that of the load to be carried together with the inertia of the various parts. Opposed to this we have, first, the weight of the air, which is 15 pounds per square inch above the piston, which is obviously gained through the escape of the water below, the cylinder being always full; secondly, the absolute weight or pressure of the water itself acting on the piston which may be derived from the city mains, or may be due to a difference of level between the bottom of the cylinder and a tank located in the upper story of the building. The result will be the elevation of the car, and the water escaping may be raised to the tank in the upper story if desired, and used over again.

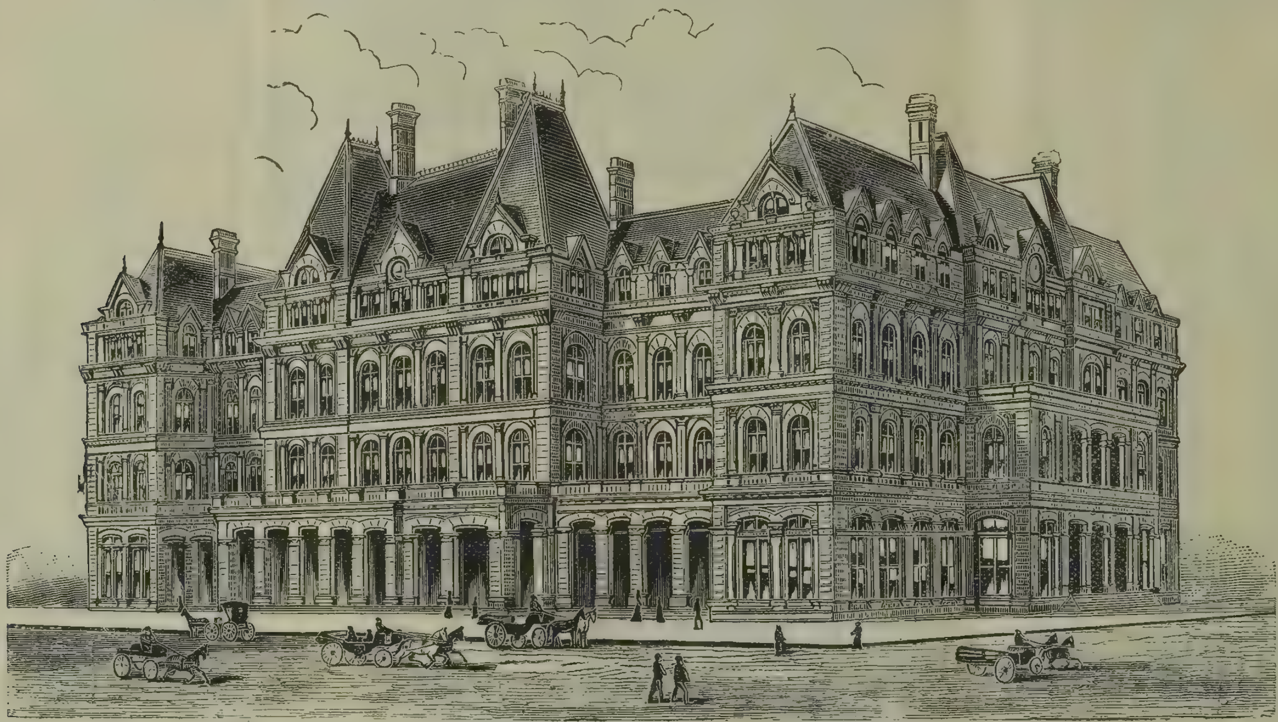
No direct application of power is made to cause the car to descend, the valve-rope being pulled by the operator in the opposite direction to that described above, when the water above the piston passes out, and the piston ascends, being moved by the greater weight of the car, which sinks with a smooth and steady action, its speed being easily regulated by the operator by opening or closing the valve. A certain range of speed is allowed him, though there is a fixed maximum which cannot be exceeded. The car stops automatically at the top and bottom of its route, and it may be called by means of an operating rope. In these machines every probability and possibility of accident has been carefully considered and guarded against. All the parts of the machine are made not only strong enough for the work required, but many times stronger than extreme prudence would dictate, and the manufacturers have spared neither pains nor expense in the effort to make their elevators absolutely safe. All the moving shafts are of steel, and all the other parts, excepting the car, of iron.

The quantity of water required for running the Otis elevator, and the attendant expense, is reduced to a minimum, the friction to be overcome being materially lessened in comparison with that of other machines of the same class, by the careful attention given to the mechanical perfection of details of construction. They are ready for use at all times, day or night, and can be operated by any person of ordinary intelligence.

These elevators have so well demonstrated their adaptability for their intended uses, that they have come into very general use for freight and passenger service in all the large cities of the United States and Canada in government and other public buildings, hotels, manufactories, business houses, stores, and private dwellings; and we are safe in making the statement that they realize most fully the desirable conditions of extreme simplicity, the highest economy, and safety in action. Among the many prominent buildings in this city in which these elevators are employed, we may mention the Morse Building, Boreel Building, Post Office, United Bank Building, and the stores of Arnold, Constable & Co. and Stewart & Co.

Chicago Government Building.

The subject of our illustration is the United States Custom House and Post Office building at Chicago. The structure is an imposing one, fire-proof throughout, of massive proportions, and the arrangement and furnishings of the interior comport well with its exterior features. The building was designed by James G. Hill, government architect.



THE UNITED STATES CUSTOM HOUSE AND POST OFFICE AT CHICAGO.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

Two stories are to be added to the six-story iron-front building No. 187 Broadway.

It is rumored that Orlando B. Potter will shortly put up a new building at the corner of Astor place.

The interior of the building No. 200 Broadway is to be altered into offices. Elevators will be put in, running from the basement to the sixth floor, and steam heat will be introduced.

On the south side of Fifty-first street, 125 feet off 9th avenue, a five-story brick apartment house is to be erected, and is to cost $28,000. The owner is J. S. Pruden, and the architect R. S. Townsend.

Work has been commenced on the new building for the Bar Association referred to in our November issue, and will be pushed forward as rapidly as possible. It will adjoin the present house on the easterly side of West 29th street, and will be 74 feet in depth, 60 feet wide, and will reach to the fourth story floor level of the present building. The front will be of red brick with brown stone trimmings, and terra cotta ornamental work. The plans are so drawn that a superstructure can be added at any time without the walls being affected. The hall or meeting-room will be on the street level, having a front vestibule with an entrance from the new and old buildings. A rear entrance will also be provided for the use of members. The library will be level with the present one and in hight extend to the ceiling of the third floor of the old house. Great pains have been taken to make this portion of the building elaborate and complete, light being obtained in front and rear by a row of small windows and two skylights. The new library will accommodate space for 2,880 feet of shelving, thus giving with the present library 5,516 feet of book space. Iron beams will be used in the construction of the building, with intermediate brick arches for the different floors. The new edifice will be built under the superintendence of Charles C. Haight, and is expected to be ready for use in the coming autumn.

Miscellaneous.

The Second National Bank is to build a large block on Center Square, Allentown, Pa. It will probably be one of the best blocks in the city.

An opera house is to be erected at Omaha, Neb., and will be completed September 5th. It will be a four-story brick building, 60x132 feet front, and will be used for stores in the first story, with an auditorium on the second. It will be finished with all modern improvements and conveniences, and will cost $100,000. Mr. McElfatrick, of Louisville, is the architect.

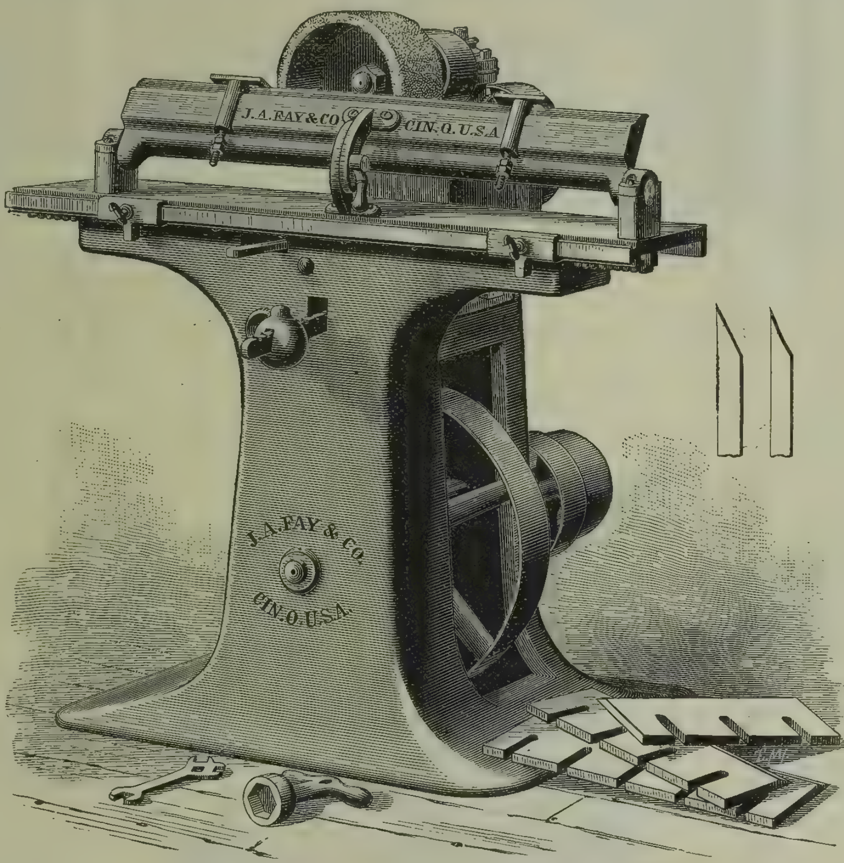
The attention of architects is invited to the professional opportunity offered in the competition of plans for a cotton exchange building in New Orleans. The building is to be four stories in hight, with an attic or mansard, absolutely fire-proof as to elevator shafts and stairways, and as nearly fire-proof elsewhere as possible without the use of iron. The cost of the building, complete, is not to exceed $150,000. The nature of the cotton business and the peculiarities of the climate of New Orleans necessitate large window spaces for light and ventilation, and a plan of building adapted to strong architectural effects. A premium of $100 is offered for the design chosen, with $500 additional for details and specifications in case they may be required.

Automatic Knife-Grinding Machine.

In our issue of last month we gave an illustration and description of a sand-papering machine, designed by the well-known firm of J. A. Fay & Co., of Cincinnati, O., to meet the special requirements of car-building shops; and in this we supplement the article referred to with a description of another recently patented machine of the same class from the shops of the same firm.

The machine here referred to and shown in the excellent accompanying illustration, is a powerful automatic knife-grinder, intended for sharpening planing-knives of all kinds, long or short, giving a true bevel and straight edge, or grinding the bevel concave, as may be desired. It is remarkably simple in construction, not liable to disarrangement, and automatic in operation; it embraces several new and important labor-saving features not before attempted in this class of grinding machinery, which have made it a favorite wherever used. The wheel employed is of the cup form, and as the knife is ground by it to a more accurate bevel, it will run lighter and can be replaced at small expense. The arbor runs in bearings upon the head-plate, arranged to move forward as the wheel is reduced in size by wear. By changing the stops on the edge of the platen, the carriage will traverse forward and back to suit the knife to be sharpened, which is clamped in a swinging frame adjustable to different angles. After being started, it will grind the knife to a proper edge and stop without further attention from the operator. The frame is neat and substantial; it is made in one solid casting of cored section, and has a large floor base. This machine occupies less room than a grindstone, and is cleaner.

The manufacturers will furnish further information on application.



AUTOMATIC KNIFE-GRINDING MACHINE.

Uses for Sawdust.

What, says the *Northwestern Lumberman*, shall we do with the sawdust? is a question which puzzles the economic brain of the man who realizes that the utilization of the fast-decreasing forests is accompanied with an amount of absolute wastefulness simply appalling. "Make it into railroad car-wheels," says an enthusiastic inventor of Chicago, who has discovered a means of compressing sawdust, bran, tea, and kindred bulky substances into from one-tenth to one-third of their original bulk. The *Lumberman* some weeks since spoke of this invention in terms somewhat of disparagement, which it subsequently modified on seeing specimens of sawdust and bran compressed into a remarkably small compass. Its credulity is further shaken on being shown a model of a car-wheel consisting of an iron rim of seven inches outward diameter by one-half inch thick, fitted with a well-proportioned hub, the space between the hub and rim filled with pine sawdust, pressed in so solidly that we are ready to believe the assertion, that, resting the iron rim upon bearings, a pressure equal to 23 tons applied to the hub failed to develop any signs of weakness. We hesitate in these days of progress to assert that anything is impossible, and we begin to think that even sawdust possesses elements of value hitherto unsuspected, and that the day may come when the filled grounds adjacent to all saw-mills may be seen to have a great value in the mechanical development and utilization of the now useless *débris* placed upon them to get it out of the way. Sawdust car wheels, sawdust brick, sawdust fence posts, railroad ties, and even sawdust window and door frames, wainscotings and moldings, begin to appear among the possibilities of the immediate future. Sawdust hair-pins, watch chains or cases, and sawdust knives and forks, or sawdust shovels, pitchforks or hoes will probably not be urged upon this generation, which will remain satisfied with utilizing sawdust in place of the more expensive basswood in the manufacture of hams and cakes of soap; but the field of possibilities is still large enough to utilize a vast amount of this valueless material.

Seriously, however, the compression of bran and oats into one-tenth of their original bulk, without injury to the substance, means cheaper transportation, which will enable their shipment to foreign lands at a profit which their bulk has rendered impossible, while with the freight on tea from China, costing about $25 per ton on account of the space it occupies, a compression into one-third its bulk would mean a saving of from three-quarters to one cent a pound on freight and labor of handling. It is not by any means impossible that we may buy a "brick of tea" in the near future which we can carry home in our vest pocket, or that the housewife may keep her truant husband at home evenings to saw the coffee up into thimblefuls suitable for the preparation of the morning draught. Verily, it would seem that with the recent discoveries of a Rip Van Winkle of the press, who, after being absent from home for a year, had to have a pilot to show him about the city of his former residence, and who, in his absence, developed a sixty-year stock of pine on the Menominee, and about as large a supply throughout the State of Michigan, there is no danger after all of a timber famine—at least so long as the sawdust holds out.

Production of Precious Metals.

From the annual report of Messrs. Wells, Fargo & Co., we learn the following facts respecting the production of the precious metals during 1880, in the United States and Territories west of the Missouri River, including British Columbia, and receipts in San Francisco from the west coast of Mexico. The aggregates are as follows:

Gold	$33,522,182	Silver	$40,005,364
Lead	5,752,390	Copper	898,000

This year Colorado carries off the honors, leading the list with a total production of $21,284,989; next comes California with $18,276,166; then Nevada with $15,031,166; while Utah and Arizona bring up the rear. In comparing these figures with those of previous years, the notable features are the leading position taken by the State of Colorado, the very constant production of California, and the relative falling off of Nevada, which for a number of years after the opening of the great Comstock mines stood far ahead of her rivals in the value of her precious metal product.

Bessemer Steel Production.

Mr. Swank, the indefatigable Secretary of the American Iron and Steel Association, is promptly on hand with the statistics of the production of Bessemer steel during the year 1880. Like every branch of trade in this country, the Bessemer industry shows the influence of the great revival of commerce and manufactures in which the whole country is participating. Mr. Swank's complete returns from the eleven Bessemer steel works in the United States, place the total quantity of Bessemer steel ingots produced during the year 1880, at the surprising figure of 1,203,173 net tons, as compared with 928,972 net tons in 1879, showing an increase over the figures of the preceding year of about 30 per cent. The following tabulation shows the growth of the production of Bessemer steel in this country since the year 1872, in net tons:

1872	120,108
1873	170,652
1874	191,933
1875	375,517
1876	525,996
1877	560,587
1878	732,226
1879	928,972
1880	1,203,173

The quantity of Bessemer rails produced from this total in 1880, was 917,592 net tons. Mr. Swank expresses the opinion that although the Bessemer steel production of 1880 was very large, it will be greatly exceeded in 1881. The Vulcan Steel Works, at St. Louis, did not go into operation until March 10, 1880; this year they will make full time. All the other old works are improving on their production of last year, and some of them will have an enlarged plant at work, notably the Bethlehem Iron Company and the Pennsylvania Steel Company. Several new Bessemer steel establishments will go to work in 1881, the Pittsburgh Bessemer Steel Company (Limited) being now about ready to begin production, with a capacity of 60,000 gross tons of ingots a year, while the North Chicago Steel Company and the Colorado Coal and Iron Company are pushing their works to completion as rapidly as possible, with a prospect of turning out Bessemer steel before the snow of another winter will have made its appearance.

Glue.—A glue ready for use is made by adding to any quantity of glue, common whisky, instead of water. Put both together in a bottle, cork it tight and set it for three or four days, when it will be fit for use without the application of heat. Glue thus prepared will keep for years, and is at all times fit for use, except in very cold weather, when it should be set in warm water before using. To obviate the difficulty of the stopper getting tight by the glue drying in the mouth of the vessel, use a tin vessel with the cover fitting tight on the outside to prevent the escape of the spirit by evaporization. A strong solution of isinglass made in the same manner is an excellent cement for leather.

Investigation of a Recent Boiler Explosion in New York City.

Most of our New York readers will recall the fact of the explosion of a boiler in the establishment of James McCreery & Co., at the northwest corner of Broadway and 11th street, on the afternoon of the 16th of January. Fortunately, the day being Sunday, when that portion of the city is deserted, no lives were sacrificed, although the force of the explosion was sufficient to do considerable damage to property. The history of this case presents some very instructive facts, as our readers will perceive in the course of this article, which will be ample excuse for giving so much of our space to its consideration. The cause of this particular explosion was at first enveloped in mystery, and it would doubtless have quietly been permitted to have taken its place among the unsolved problems, had not the circumstances investing it been fortunately submitted to searching and critical investigation and analysis by Mr. Joshua Rose, a keen observer and thorough mechanic, the result of whose investigation dispelled the mystery and made the cause of the disaster evident. We give in what follows a detailed history of this interesting case, making free use of Mr. Rose's observations and inferences.

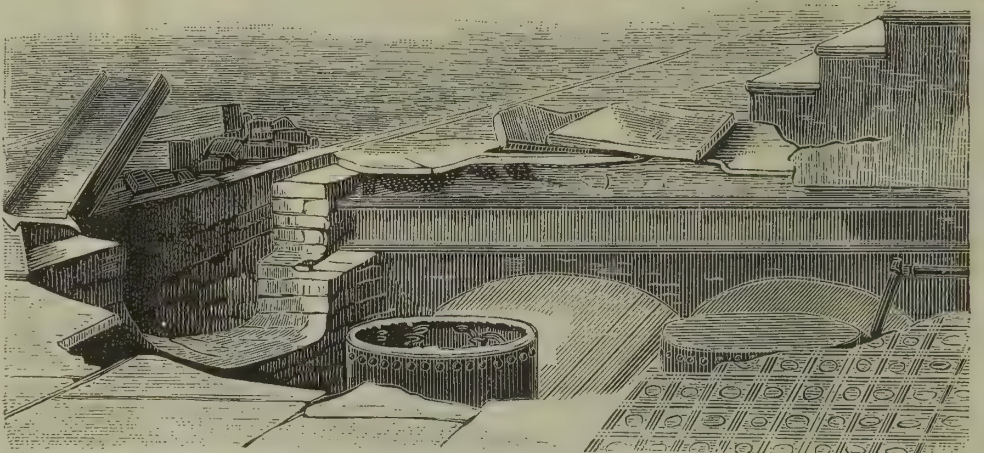


Fig. 1.—Exploded Boiler, Showing the Upheaved Sidewalk and Broken Iron Girders.

The boiler that exploded was one of a pair of multitubular boilers, located beneath the sidewalk of the establishment before mentioned, and which were used to heat the store and drive the elevators. The attendant in charge stated, subsequently to the disaster, that he had banked the fires as usual on the Saturday night preceding the explosion, that he had returned on Sunday—the day of the explosion—at a little past noon, when he had cleaned the fires, and again banked them. He stated also that he had examined the dampers, and saw that they were closed; examined the pressure gauge, and found it to indicate 3 pounds; saw that there was plenty of water in the boiler, and then left, believing that everything was safe. The fireman, who was present at the time, corroborated these statements. The watchman was also confident that the dampers were closed, from the fact that shortly afterwards he found the smell of coal gas in the building to be so oppressive that he was obliged to notify the burglar-alarm office that he was about to open the windows to let it out. Within a short time after this, however, the explosion occurred, which tore away the massive girders overhead, blowing up the sidewalk above them, but fortunately, as before remarked, without causing any loss of life or injury to person. The boiler had been in service for ten years, had been tested by hydrostatic test at 105 pounds, was licensed for 70 pounds, and was usually worked at 50 pounds. The above were the points developed at the subsequent examination, and on the strength of which the newspapers designated the event as a mysterious explosion. The careful investigation of Mr. Rose, whose observations we summarize below, completely cleared up the mystery.

Referring to the illustrations, Fig. 1 shows the appearance of things immediately subsequent to the explosion, with the two boilers, the exploded and the sound one, side by side. The immediate cause of the explosion, as will be seen by this engraving, was the blowing off of the crown-sheet of the dome of one of the boilers, which, it will be observed, was blown off completely, and, as subsequent examination revealed, leaving a ragged fibrous fracture right in the flanging bend. This is shown at A, in Fig. 2, which is a sectional view through the dome of the uninjured boiler. In the explosion the dome head was torn into two completely severed pieces, one of which is shown by Fig. 6, and an examination of this fracture showed an excellent fibrous appearance, indicating, so far as such indication goes, metal of good quality. One important observation was made, however, which went far towards revealing the cause of the explosion. It was observed that the crack around A was too rusty to warrant the conclusion that it had been of recent formation.

The six stays, three of which are shown in position in Fig. 2 (one-11th full size), were found to have remained in place; and it was noticed that their contact surfaces with the dome were polished, indicating a certain amount of movement and slight abrasion. This fact, taken in connection with the rusted appearance of a portion of the crown-sheet of the dome at the line of fracture, it will shortly be seen, warrants certain important inferences.

The rusted condition of a portion of the fracture in the crown-sheet of the exploded dome, as above remarked, makes it reasonably certain that the fracture was not of recent formation, and it becomes, therefore, of interest to inquire what could have caused the fracture. A careful inspection of the disposition of the stays used for strengthening the dome, demonstrated with reasonable certainty that they were responsible for starting the fracture.

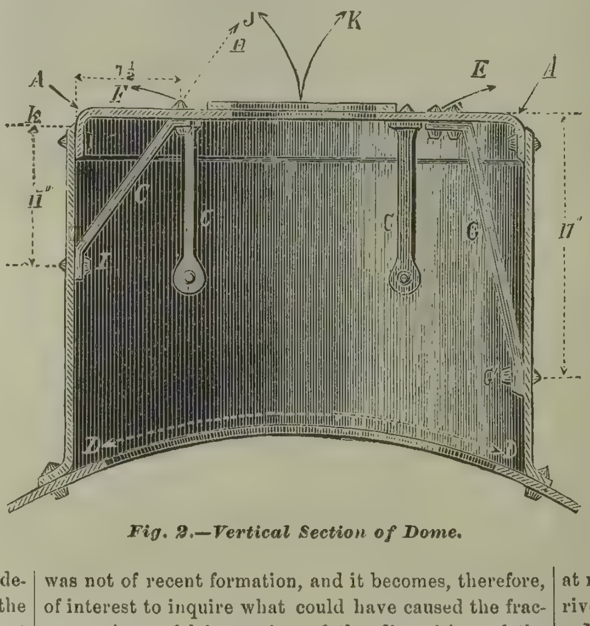


Fig. 2.—Vertical Section of Dome.

Referring to Fig. 2, it will be noticed that the stays joined the cylinder of the dome 11 inches from the top, and the crown-sheet 7½ inches from the edge of the cylinder. The expansion of these stays under increased temperature, would exert a pressure on the crown-sheet in the direction of H, tending to lift it. The steam pressure would also tend to lift the crown-sheet; hence, as the pressure and temperature increased and decreased, the crown-sheet would lift and fall, bending on A as the center of motion. The stays were placed at too great an angle to resist this movement to advantage; thus, taking I as a center, the movement of the other end of the stay would be in the direction of F, while at D the direction of motion would be towards J; hence the direction of motion of the two would to a great extent coincide.

Where stays are placed at a considerable angle, as in this case, they will, under any increase in temperature above that at which they were riveted up, tend to push the two plates apart until the weakest plate has moved a certain amount. Thus the stays measuring 15 inches, will expand a certain amount per inch through a length of 15 inches; but the shell of the dome will only expand an equivalent fraction of 11 inches—the distance of its vertical hight from hole I; hence to the amount that the stays would expand in 4 inches (the excess of length), they would push against the crown-sheet, and assist the steam in lifting it; and not until the crown-sheet endeavored to rise still further would they begin to act as stays, to resist the motion. As the angle of the stay diminishes—that is, as the stay is placed more nearly vertical, this effect will be correspondingly decreased. In the new domes with which these boilers are now provided, this defect has been perceived, and the stays have been increased from six to ten, which have been placed so as to coincide more closely with the line of strain, as seen at G. The new stays also have a double rivet, the foot being a crow-foot, as shown in Fig. 3.

Another defect observed, was the fact that the shell of the dome has the wide side of the punched holes on the inside, as shown in Fig. 4, the consequence of which will be that the rivet has less hold on the shell, and to whatever extent the rivet fills and binds against the walls of the shell, it tends to force the two plates apart instead of binding them together. This, however, is merely incidental, since, as we have learned from what has preceded, that the improper position of the stays induced the crack along the line of the flanging bend.

Now, while this explains the crack, it does not explain how it should happen that a boiler tested in August last at 105 pounds, and used daily during the week before the accident at pressures varying from 40 to 50 pounds, should explode under a lesser pressure, or even under a pressure of 60 pounds, especially as it had a safety valve set to blow off at that pressure.

The engineer, on being questioned a second time, gave the following information: On his last visit previous to the explosion, he "cleaned the dirt out of the fire and put fresh coal on, leaving the fire covering the bars," which was his usual method of banking, and the method practiced before he took charge. He usually left from 3 to 5 pounds of steam after banking at night, and found from 20 to 25 pounds when he arrived in the morning.

Mr. Rose here very properly points out that this method of banking is a decidedly dangerous one, because a little extra cleaning of the fire, the use of larger coal than usual, or leaving a rather better fire than usual, would simply cause a more rapid production of steam, whereas it appears that it was not uncommon to find the boiler in the morning with a pressure of within 15 pounds of that under which it was daily used.

The proper way to bank a fire, he adds, is to pile it at one end of the grate bars, leaving nearly two-thirds of them bare, so that cold air would pass in freely if the fire burned up, and check any undue combustion, even if the dampers were left open. The practice of

smothering a fire by leaving it spread over the bars and simply giving it a fresh covering of coal and closing the dampers, is a common and unsafe practice that ought to be prohibited.

But one more point remains to be explained, which is: How did it happen that the test made in August did not develop the weakness of the crown-sheet? On this point we think there can be no escape from the conclusion that this case affords another demonstration of the insufficiency of the hydrostatic test to discover many of the dangers to which boilers are exposed, and an additional argument in favor of its abandonment for the hammer test, which would without question have disclosed the flaw in the crown-sheet, and thus have averted this explosion. This is the position which the Hartford Steam Boiler Inspection and Insurance Company have long ago taken, and it would be well if the facts that have been accumulated in evidence of its correctness could be brought to bear on the modification of the laws regulating government and municipal inspection.

On this very important point, Mr. Rose declares himself as being decidedly in favor of supplementing the hydrostatic test with the hammer test. He says: "There has been for years a discussion carried on as to whether the hydrostatic test was sufficient alone, or whether the hammer test was not a necessary adjunct to the hydrostatic one—some indeed claiming that the hammer test alone is more reliable than the hydrostatic test. In this city the hydrostatic test alone is employed, and since so high an authority as Inspector Horton says that it may not discover an existing defect, but may induce a dangerous one, it is about time that it was supplemented with the hammer test. There

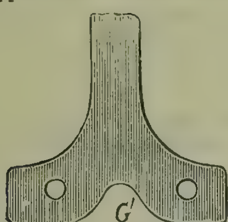


Fig. 3.—Brace-End.

is no doubt that the hammer test would have disclosed the defect in this boiler, and that Mr. Horton's views are entirely correct."

Finally, he concludes that as the safety valve was set to blow off at 60 pounds, and the boiler was daily used at from 40 to 50 pounds only, there is nothing to indicate that the boiler was, at the time of the explosion, capable of carrying, say 55 pounds; hence the explosion might occur when this pressure was reached without being relieved by the safety valve. This would leave the pressure to run up, under unusually favorable conditions, probably to but 30 pounds more than it sometimes was found at in the morning, which would easily be accomplished with no consumption or circulation of steam through the building taking place.

The thoroughness of the crown-sheet fracture is shown in the one-half of it, presented in Fig. 6. The iron is what is termed three-piled—that is to say, the mass from which it was originally made was composed of three thicknesses welded together, and it was defects in this welding, from the presence of dirt or other foreign material, which, when rolled out, formed these laminations. Now, in an unbent sheet the laminations would not form such serious defects, but in flanging or bending the edge, the laminations would tend to separate, and undoubtedly to some extent did so, weakening the plate at A, where the bend and the fracture took place.

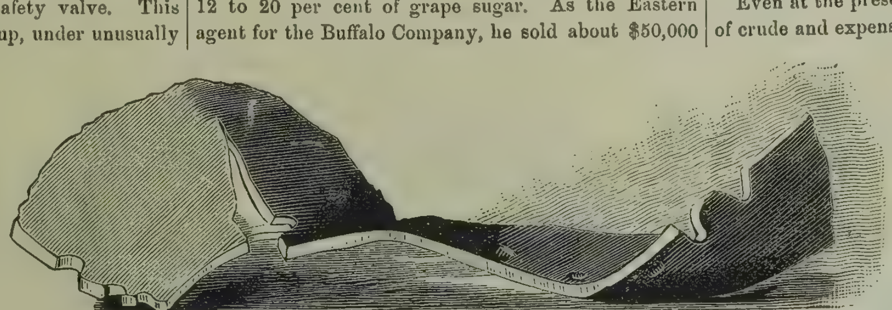


Fig. 6.—Half of the Crown of the Dome.

New Method of Making Artificial Stone.—Artificial stone can be produced by the following process, recently suggested by Ternikoff: A mortar consisting of equal parts of lime and sand is exposed for a few hours to a temperature of 150° Centigrade in the presence of water vapor. The paste having been taken out of the furnace, is now passed under the cylinders of a machine like that used for molding bricks, and it comes out in the form of cubes, which, on being ex-

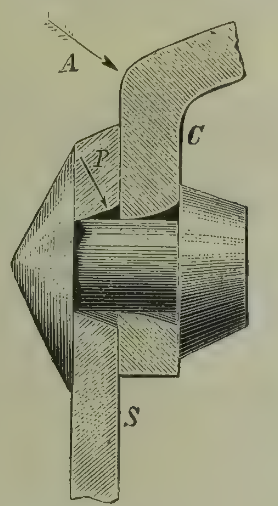


Fig. 4.—Joint.

posed to the air, become dry and hard. In the course of eight or nine hours, these cubes are said to become as hard as good building stones, and are fit for use. This artificial stone is, in fact, a sort of brick or mortar baked at a low temperature, and the cost, too, is about the same as that of bricks.

Uses of Grape Sugar.

In the course of a recent trial, some interesting revelations were made both as to the process of manufacture and the uses of glucose. The dry quality is used in the manufacture of ale, beer, wine and vinegar, and is consumed in great quantities in the making of confectionery. Table syrup is made from glucose syrup by the addition of a little cane syrup, to give it flavor. In combination with sugar, it is extensively used in the manufacture of tobacco. One witness testified that he was the inventor of a process of mixing grape and cane sugars. He used six tons a day in his business. He mixed it with all grades of cane sugar, so as to make a lighter color and raise the grade. He used grape sugar which cost him about 3½ or 4 cents a pound, and sold the product at from 6½ to 8 cents a pound, according to the grade. He called it "new process sugar," and said he sold over 200 barrels a day. It contained from 12 to 20 per cent of grape sugar. As the Eastern agent for the Buffalo Company, he sold about $50,000 worth of glucose a month, mostly to confectioners and brewers.

Glucose is manufactured by grinding corn and by treating the starch obtained, with sulphuric acid. The manufacturers claim that a subsequent boiling and filtering through marble dust removes all traces of the acid and purifies the article. The product is finally run through bone black, and then boiled in vacuum pans to the consistency desired. It goes to market either as a thin syrup, a thick syrup, or as a solid, with the consistency of sugar. It is white and insipid. The total cost of manufacture, including taxes, insurance, and cost of transportation, was stated by one witness to be 25 cents per bushel of corn, the product of which was about 30 pounds of glucose, worth about 4 cents a pound. Besides this, a bushel of corn produced nearly a bushel of refuse, which brought about 6 cents as a food for stock. The profits have been enormous, being estimated as high as $1,000,000 per annum on a capital of $400,000.

Russian Petroleum.

The monopoly which this country has so long enjoyed in supplying petroleum for the world's consumption, bids fair to be terminated in the near future by the competition of a region, which, in respect to productiveness, can be made to equal, if not even to surpass the famous oil regions of Pennsylvania and West Virginia. We refer here to the great petroleum district of the Russian empire, which extends for a considerable distance from the western shores of the Caspian Sea. The naphtha deposits of this region have been known to exist from time immemorial, and in ancient times the flaming gas which issued from the ground in many places in that region, played an important part in the religious ceremonies of the people.

Recently, however, the immense extent and importance of the American petroleum industry have opened the eyes of the Russians to the value of these long-neglected oil fields, and their development has for some time been quietly taking place. The greatest obstacle to the growth of the petroleum industry of that region, is the lamentable want of means of transportation to bring the product to the seaports and other distributing centers of the empire, whence it might find its way, as the American product has already done, to all

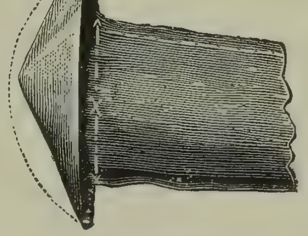


Fig. 5.—Rivet.

parts of Europe. This obstacle, it is asserted, will soon be removed by the construction of railways properly equipped with tank cars, and of pipe lines, which will bring these vast reservoirs of oil into close commercial relations with the markets of the Black Sea and the Mediterranean.

Even at the present time, with all the disadvantages of crude and expensive means of transportation to contend against, the production of refined oil at Baku is not far from 2,000,000 barrels—a production which will be greatly increased when the prospective transportation facilities are provided.

United States Consul Dyer, who has written a lengthy and valuable report upon this subject, does not hesitate to say that the American petroleum industry will speedily be brought face to face with a severe competition from Russian sources of supply, and asserts that our producers will be forced to divide to some extent with Russia their great and profitable traffic in illuminating oil.

Population of the World.—From the latest edition of Brehm & Wagner's *Bevölkerung der Erde*, we glean that the population of Europe numbers 315,929,000; Asia, 834,707,000; Africa, 205,679,000; America, 95,495,000; Australia, 431,000; and the Polar regions, 82,000; giving together an aggregate of 1,455,923,000, an augmentation over the last known census of 14,778,000.

Sponges.

Sponges present a point still somewhat problematical as to their true position in the scale of animal life, and there are still many doubtful or imperfectly known facts pertaining to their organization. As a family, sponges are very remarkable for the lack of a definite and constant form, have various habits of growth, are insensible to irritation, and powerless to move about. The known species number now about three hundred, and new ones are constantly observed, in view of which fact it is obviously impossible to describe, within the limits of this sketch, more than the prominent characteristics of the type. The description following may be referred more particularly to the sponges of commerce.

Milne-Edwards and others have considered each sponge as one separate and distinct individual; but Prof. Clarke, Dr. Lockwood, Prof. Grant and others, regard them as an aggregation of minute infusoria, each within its living cell, and they are considered to begin life as solitary animalcules, and only in associations of these does the characteristic sponge structure appear. Of course this reduces it still lower in the plane of animal life, because individuality is soon lost when many of the same species are brought together and coalesce. The mass then may be considered in its complete state as being composed of three parts, namely, the *skeleton*, known, when cleansed, to commerce as the sponge; the *fleshy matter*, by which this is surrounded; and third, the *spicules*, or little spines, by which the fleshy matter is held in place.

The skeleton is a fibrous mass of complicated network of more or less regularity in the meshes, and of different patterns in the various species. The fiber appears solid under the microscope, but in some species at least it contains within its interior another cylindrical thread, which usually becomes elegantly wavy or spiral under flexion, and probably adds to the elasticity. In some the skeleton is soft, compressible and very bibulous, from which there is a gradual passage into those of a rigid and compact texture, sometimes friable. The first are composed of a horny substance, and the varying excess of silicious or calcareous matter causes it to lose more or less elasticity, and impairs its usefulness. As the skeleton is secreted by the fleshy mass of the animal, which is an active eliminator of the salt of the ocean, it is attempted to group them upon considerations of their building propensities, and the toilet and domestic sponges generally affecting horn, or *keratose*, are grouped as "keratora." With an excess of lime, as *calcarea*, building with silex—

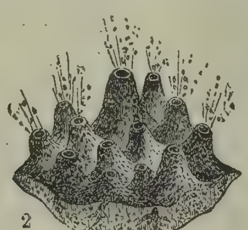


Fig. 2.—Living Sponges.

silicea. Various varieties exhibit all the colors, and many are, while alive, very brilliant in appearance. Examining a toilet sponge, we find that the framework is covered with a membrane (not universal with all species), thin above, deep brown on the sides, and yellowish brown towards the base. This investing membrane exhibits larger and smaller openings, is not spread smoothly, but appears irregularly covered with conical shaped points. Making a section of the still living sponge, we find the skeleton embedded in a glairy, gelatinous or albuminous substance, about the consistency of raw beef, with an exuding viscous, yellowish clear brown (in the bath sponge a clear gray) slime, called milk by Greek fishermen. This investing flesh has so little resemblance to ordinary animal tissue, that it is technically called "sarcode." In this tissue we perceive a system of canals or pores, which run downward in all directions, and enter directly certain little cavities or chambers connected with circuitous passages which finally lead to large outlets or "oscula." The pores, belonging only to the flesh, are not visible in the skeleton, are very small, yet, compared with the cells, very large. In some orders of sponges the outer walls of the flesh open anywhere and everywhere for the admission of food, and no well defined pores are visible, but open as required.

Fig. 1.—Sponge (one-half Natural Size) Attached to Rock.

Prof. Grant first observed closely the ceaseless flow of liquid matter through and out the living sponge. Another discussion has been had over the manner in which this is caused or maintained. Dutrochet, having made his celebrated discovery of that law of endosmose which regulates the transmission of fluids of unequal densities through organic membranes, was perhaps biased or prejudiced in applying the same law to the solution of this problem. At any rate, naturalists now agree that the flow is produced by the lashes or cilia with which the unnumbered animalcules are each provided. The little chamber into which the pore opens has its wall lined with these uniciliated cells, and each lashes its cilium with vigor, and all harmoniously downward and inward, the effect vacuum above, the water of course passing in, being carried through the ramifications and out of the oscula with some vigor. Hurled along in the liquid are opaque masses, composed of excrementous particles, and at certain seasons ova and germicules, from which new beings are produced. We may consider the sponge mass as having a complete assimilating or digestive apparatus. The cells, or some of them, probably act as stomachal sacs, with the lashes for motors to attract food and repel refuse after the extraction of nourishment, which latter probably passes through the gelatinous mass into the general development. The sponge has such remarkable recuperative powers that one, being cut while alive, quickly rejoins, though not replaced in the same position. We show in Fig. 2 a group of living sponges.

Perhaps the most curious parts of the sponge structure are the *spicula*, or little spines, shown in Fig. 3. These, embedded in all parts of the sarcode, serve to bind the tissueless flesh in form. They serve as a natural felting, or as tiny anchors, generally composed of silex or lime, and are of an infinite variety of shapes, sometimes occurring separately and sometimes in bundles, generally in this case bound together with horny matter. The spicules of the "sheep's wool" are of the latter class, and under a low magnifying power will be found generally broken and frayed. Spicules of silex are the most common and most variable in shape, and present every gradation, from simple needle to many-pointed star. Spicules of the same material, but of various forms, are found in the same sponge, but seem to occupy certain definite positions—some are peculiar to crust, some to sarcode, and others to margins of canals, etc. They cannot be considered as formed by crystallization, as many could not so be produced; they exhibit more or less of a central cavity, in some of which organic matter has been discovered. Being beautiful microscopic objects, they have excited much attention, especially as they are the most lasting parts of the structure, and are distributed not only over every known sea, being constantly dredged from the greatest depths, but they also in a large measure, in connection with other silicious bodies of like insignificance, go to form many large portions of the earth's surface. They occur in guano deposits, largely in the chalk formation, also in the tertiary formation in England, etc. Sponge tissue may often be observed in sections of agate, chalcedony, etc. Nodular flints are believed to be fossil sponges, as are also the celebrated "moss agates." Fossil sponges of many species are found in many localities in this country, notably in Kentucky and Tennessee. Spicules predominate so far in some sponges as to render them valueless, and their absence is always essential to its domestic uses.

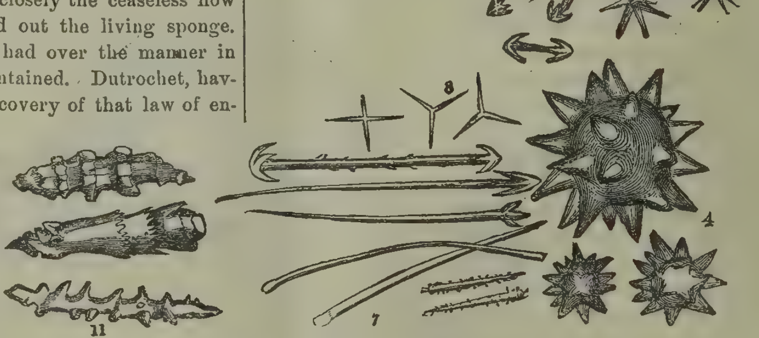


Fig. 3.—Spicules of Various Forms.

The sponge is propagated by an *ovum* or *germicule* cast from the parent at certain seasons, this being usually a ciliated cell, which, floating for awhile, at last settles for life on some hard substance, and, giving no signs of sensibility, yet undergoes a change, the gelatinous flesh is riddled and channeled, the fibrous framework is formed, and the sponge is complete.

The process of generation is involved in some doubt,

but they seem to contain within themselves the power, and seemingly by germination or budding. These germicules are apparently produced in some of the cells, and pass through the sarcode to the large canals, from which they are ejected, sometimes being protected and surrounded at their exit by spicules.

The duration of life and rapidity of growth are not known, though in the Mediterranean it is agreed that the ground may be fished over again in three years. The period probably varies greatly in different latitudes, for the species are widely distributed over the seas; they are scarce and small in cold latitudes, and increase most abundantly in the tropics.

Many strange and beautiful forms occur among sponges, some of which have received popular names, as, Feather, Fan, Bell, Lyre, Trumpet, Distaff, Peacock Tail, Neptune's Glove, Neptune's Car, Venus' Flower-Basket, Glass Sponges; etc.

The cornucopia-shaped Glass sponge, the Venus' Flower-Basket, (*Euplectella-speciosa*—the specially beautiful well woven), is one of the rarest, and, as its name implies, one of the most beautiful varieties. It is found near the Philippine Islands. It resembles a structure of spun glass, and though apparently so delicate, is yet quite strong, each thread, although of pure silex and seemingly solid, is really composed of a series of concentric tubes or cylinders, as if spun on a central thread. As the threads are of pure silex, one might suppose them to be perfectly transparent; but, on the contrary, they are translucent, and have a most exquisite opalescence. The structure has a woven fabric, and as it progresses it takes on the most quaint little flounces, with the most delicate frilled edges imaginable, and all arranged with such charming grace and ease. The lace-like structure is so aerial a fabric, so quaintly graceful, and so deftly done in the putting together, that any embroidery would seem bungling in comparison.

The *Cliona*. Sponges to which this name has been given, have been observed to have the power of boring into substances the hardness of which might be considered a protection from such apparently contemptible foes. Shells, corals and solid rocks are broken up and probably made available for the supply of the necessities of other creatures. The mechanism by which so low an animal produces such remarkable effects is still doubtful, but is attributed to a multitude of minute silicious crystalline particles adhering to the surface and set in motion by something analagous to ciliary action.

The Mediterranean and Red Seas have from time immemorial afforded the finest sponges of commerce, and at the present time the most important sponge fisheries are those of the Grecian Archipelago and the coast of Syria, the products of which find their way to all parts of the world. The trade in sponges with Europe and America has of late greatly increased. Some three or four hundred boats are regularly engaged in the sponge fishery in these waters during the fishing season, which usually commences about the beginning of June and terminates at the close of October, the months of July and August being the most favorable for the pursuit of the industry. The method pursued by the sponge fisher is about as follows: A boat's crew of four or five men will scatter themselves along the coast for two or three miles, in search of sponges under the cliffs and ledges of rock. Those of inferior quality are found in shallow waters; the finer qualities are only found at a depth of from 20 to 30 fathoms. The first are fished for with three-pronged harpoons, by which they are forcibly torn from their rocky attachments, with more or less injury to their textures. The finer kinds are collected by divers, who descend to the ocean's bed and carefully cut them from their fastenings with a knife.

The sponge fisheries of the Archipelago yield a large annual product, but the quality is not so fine as that of the Syrian fisheries, while the Syrian sponges in turn are surpassed in dimensions and fineness of tissue by the product of the Barbary coast. The sponge fishery of these favored regions is conducted without intelligent direction or thought of preserving the supply, in consequence of which the product, though it has of late largely increased, must in time become restricted in

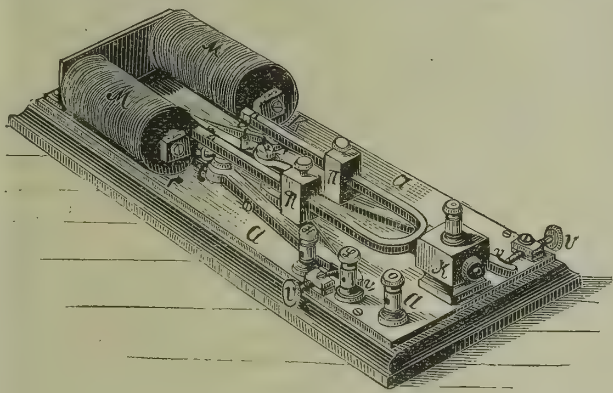


Fig. 1.—La Cour's Phonic Wheel.—Actuating Tuning-Fork.

quantity from the failure of the supply. Well informed writers on this subject, in fact, assert that it is only a question of time when the trade shall altogether cease, unless some reform in the existing state of things shall be introduced, as the demand which every year clears the submarine fields of these sponges causes such destruction that even the prodigious reproductive power which they possess is inadequate to keep up the supply.

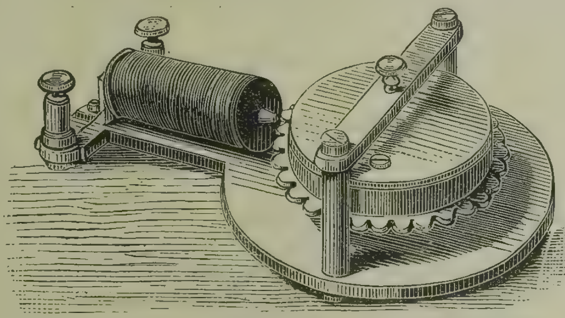


Fig. 2.—La Cour's Phonic Wheel.—The Toothed Wheel.

To successfully counteract the rapid depletion of the sponge in these waters, it has been repeatedly proposed to naturalize the more valuable species on the French and Algerian coasts, and to protect their cultivation by special laws. It has been conclusively demonstrated that sponges may be artificially propagated with little trouble, and with successful results, from cuttings of the living sponge, so that no serious difficulty

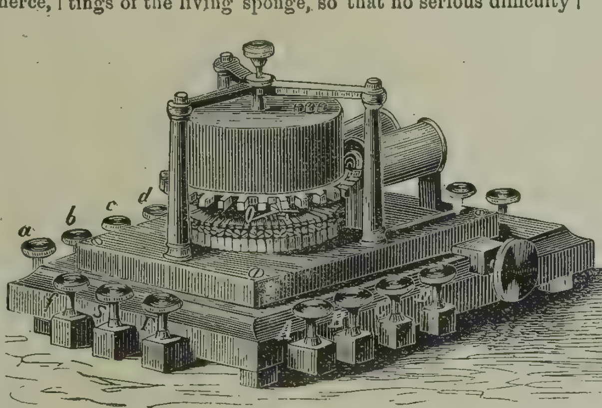


Fig. 3.—La Cour's Phonic Wheel.

would be met with on this score; but thus far, for a variety of reasons, no practical measures of this kind have been taken.

The sponge fisheries in American waters are by no means insignificant, the principal localities of the industry being the Gulf of Mexico, the Florida Keys and the Bahama Banks. The quality of American sponges, however, as compared with those of the Mediterranean, is inferior. The annual product of the American fisheries is, nevertheless, very considerable. The fine Syrian sponge is distinguished by its lightness, its fine flaxen color, its fineness of texture, and its cup-shaped form. This sponge is specially employed for toilet use, and commands a high price. The fine sponge of the Grecian Archipelago is scarcely to be distinguished from that of Syria, though generally it is weightier, not so fine in texture, and the holes with which it is pierced are larger and fewer in number. The sponges of American waters are coarser in texture, harsher, and wanting in flexibility.

The Phonic Wheel.

Since the telegraph in our day has been confronted with the formidable rivalry of the telephone, it may appear somewhat unimportant to many of our readers to chronicle the recent progress that has been made in the improvement of the details of the telegraphic service. Nevertheless, while the telephone has so happily solved the problem of the instantaneous interchange of thought within limited distances, the telegraph must, and probably will, continue to be our sole reliance for such communication at great distances where the capabilities of the telephone fail us.

It has been the object of numerous inventors in the field of the telegraph to devise a plan whereby the possibilities of errors in the transmission of messages should be reduced to a minimum, or entirely avoided, and to this end their efforts have been directed to the invention of a simple, reliable and rapidly operating printing-telegraph, by means of which the words of the message could be recorded at the receiving station, not in the lines and dashes of the Morse system, but printed in type upon the ribbon. A number of such printing-telegraphs have been devised, and are in successful use. They have, in addition to the advantage of greatly lessening the liability to mistakes in the sending of messages, the advantage of not requiring special expert knowledge in the operator, as any intelligent person with an experience of twenty-four hours can send and receive messages upon these instruments without difficulty.

The purpose of the present article is to explain certain substantial improvements relating to this class of telegraphic apparatus, which have been devised by M. Paul la Cour, of Copenhagen. The invention in question is termed the "Phonic Wheel," and is designed to secure perfect regularity in the operation of the printing-telegraph, as will appear from the following description.

Before describing this ingenious apparatus, however, it will be necessary to refer to the general construction of printing-telegraphs, to understand its proper function. In all printing-telegraphs, the letters which print the words upon the paper ribbon are disposed upon a single (or several) rotating disks, the so-called type disk or wheel. As soon as the particular letter to be printed has arrived at the roller over which the paper band is carried, another mechanism must instantly be set in action to do the printing. The operator at the sending station, therefore, must know the precise instant of time at which a certain letter has arrived before the printing apparatus at the receiving station, in order to be able to set the printing mechanism in action at the proper moment. With certain printing-telegraphs the arrangement of the apparatus is such that the type-wheel at both the sending and receiving stations is set in rapid and uniform motion. To secure such absolute uniformity of motion, however, which is necessary in order that the printing mechanism shall act with certainty, demands the intervention of somewhat complicated apparatus, or the use of a strong current.

As a good example of a rapid and reliable printing-telegraph we may take the apparatus of Hughes in

which the type-wheel makes two revolutions per second, placing at the service of the operator 80 letters in that time, of which, however, only about 4 can be printed. This apparatus, however, is much too complicated to warrant its general introduction. In the Hughes apparatus synchronism (the movement of the type-wheels uniformly in equal times) is established and maintained by means of clock-work, which requires to be wound up several times each hour.

A wonderfully simple apparatus for the purpose of maintaining the synchronous movement of two wheels or disks, set in action by an electric current, is the above named "phonic wheel" of La Cour. It consists of a toothed disk of soft iron, before which is placed an electro-magnet, magnetized by a succession of rapid and uniform electric impulses, (see Fig. 2, on preceding page.) These current impulses are established by means of a special apparatus, an important part of which is a tuning-fork, the rapidity of whose vibrations may be modified by shifting weights, in order that a number of tuning-forks may be made to vibrate in uniformity. This portion of the apparatus is shown in Fig. 1. The tuning-fork is supported from the post K, and opposite its free ends are the polls of two electro-magnets M M. When at rest, the ends of the fork are in contact with two slender metallic strips, which constitute the terminals of an electric current, of which likewise the electro-magnets form a part. When the current from the battery is started, it magnetizes the two electro-magnets. The magnetism developed in their poles draws the extremities of the tuning-fork apart, and, as a result of this action, the contact with the above named metallic strips is broken, and the current is interrupted. The electro-magnets instantly lose their magnetism, and the ends of the tuning-fork vibrate back to their normal position, and beyond it. Contact with the metal strips is again established, the current passes again, the electro-magnets are again magnetized, and the fork is thus maintained in perpetual vibration.

By this device a series of current impulses pass through the conducting wires of the circuit, and the rapidity of these successive impulses will be controlled by the rapidity of the vibrations of the tuning-fork. These current impulses magnetize, with the same uniform interruptions, the electro-magnet placed before the phonic wheel, Fig. 2, the first impulse attracting the tooth nearest its pole, the following one the next tooth, and so on. It will be manifest, therefore, that where a number of such phonic wheels are introduced into the phon-electric circuit above described, they should all be set in motion and continue to move with perfectly uniform velocity.

There is a certain practical difficulty, however, which modifies the absolute synchronism of the disks, but which is provided against by the inventor. This difficulty consists in the fact that the movement of the toothed wheels is accomplished by a species of pendulum-like movement, which may cause a slight irregularity in movement. This irregularity will be less with a heavy wheel than with a lighter one. To provide against it, La Cour has devised a simple regulator, consisting of a closed cup or capsule, filled with quicksilver, which is placed upon the wheel, Fig. 2. Now, in case the wheel should move too slowly, the quicksilver in the capsule having a greater momentum by reason of its more rapid movement during the preceding impulses, accelerates the movement of the wheel by the amount of its retardation. Should the wheel move too fast, the slower movement of the quicksilver acts as a brake to retard it. Thus the mass of quicksilver, by its inertia, controls any irregularities in the movement of the wheel, and preserves a practically uniform motion.

If now a printing-disk is connected with the phonic wheel, (an arrangement which must be set up at each station), and the position of the letters on the printing-disks of sending and receiving stations is the same at the outset, it is manifest that the operator, by means of a second wire, can actuate the printing mechanism at a distant station as soon as the letter he wishes to print has reached the proper position in his own, the accuracy and reliability of the printing being assured by the regulating action of the phonic wheel.

The printing-wheel, and the printing mechanism, with inking roller, paper ribbon, etc., have been omitted from the illustrations accompanying this article, as they are sufficiently well known. The printing-wheel is connected with the phonic wheel by an elastic connection, in order that the movement of the latter shall not be effected by the retardation the former suffers while printing.

From the foregoing, it will be perceived that the speed of all the type and phonic wheels of one system must be practically synchronous. If at the beginning of a day's work all the type-wheels are set to a certain letter, the synchronism will be perfectly maintained throughout the day, as numberless practical trials of the apparatus have amply demonstrated.

The wheel shown in Fig. 3 has 30 teeth, and as the tuning-fork of the phonic system makes 90 vibrations to the second, it makes three revolutions in the same time; while in the Hughes printing telegraph the printing-wheel makes but two revolutions per second. Beneath the wheel sixty contacts are provided, upon which the spring O slides, and of which the 1, 11, 21, 31, 41 and 51 are connected with A; the 2, etc., with *a*; the 3, etc., with B; the 10, 20, etc., with *f*, etc.

The special mechanism for printing it will be unnecessary to describe, as we are not specially interested in that portion of the system. It may be added, in conclusion, that the phonic wheel, if only for the special application above described, is an instrument of great utility; and it is anticipated that other and probably equally important uses will be found for it in the future.

Scientific.

HEARING NOISES TAKING PLACE ON THE SUN.—The foreign scientific journals have extensively published the following interesting and suggestive article: "On visiting the observatory of Meudon, at the invitation of M. Janssen, Mr. Graham Bell examined with much care the large photographs which are being made there for the study of the solar surface. M. Janssen having informed him that he detected movements of a prodigious rapidity in the photospheric matter, Mr. Bell had the idea of employing the photophone for the reproduction of the sounds which these movements must necessarily produce on the surface of the sun. M. Janssen approved of the idea, and requested Mr. Bell to attempt its realization at Meudon, placing all the instruments of the observatory at his disposal. The weather being very fine on the day appointed, Mr. Bell came to Meudon to attempt the experiment. A large solar image of 0.65 meter in diameter was examined with the selenium cylinder. The phenomena were were not sufficiently decided to be regarded as successful, but Mr. Bell does not despair of succeeding on further examination. M. Janssen suggested that the chance of success would be much greater, if, in place of directly interrogating the solar image where the variations are produced, though responding to considerable changes on the sun's surface, are not sufficiently rapid even in the most powerful instruments to cause the production of sounds in the photophone, a series of solar photographs of one and the same spot, taken at sufficient intervals to obtain well-marked variations in the condition of the spot, might be passed with a suitable rapidity before an object glass, which would give conjugated images upon the selenium apparatus. This would be a means of condensing into a time as brief as could be desired the variations which in solar images are much too slow to give rise to a sound. M. Janssen has placed himself at Mr. Bell's disposal to provide him with solar photographs suitable for carrying out this idea, and the latter has sent M. Janssen the requisite photophonic apparatus. It has appeared to M. Janssen that the idea of reproducing on earth the sounds caused by great phenomena on the surface of the sun was so important that the author's priority should be at once secured.

DELICATE TESTS FOR POISONS.—Herr Rossbach calls attention in one of the Austrian medical journals to the remarkable sensitiveness of a number of small animals, such as frogs, mice, etc., to the effects of poisonous alkaloids and glucosides, and suggests that this extraordinary susceptibility may be taken advantage of to detect traces of many poisonous substances so minute as to be beyond the power of the chemist to detect.

In support of this suggestion, he asserts that .00005 of a gramme of strychnine will cause tetanus and death in frogs and mice; that .000005 of a gramme of curarine will cause paralysis of the ends of the motor nerves in frogs; that .00001 of a gramme of digitoxine, or .00005 of a gramme of antiarine, will cause systolic stoppage of the heart, etc. He adds to these facts others of special interest, which embrace tests still more delicate. A drop of water containing infusoria having been placed on a microscopic slide, without being covered, is brought under the objective, and, while the infusoria are carefully watched, the minutest possible drop of the solution suspected to contain poison is allowed to touch the edge of the fluid on the glass. If organic poisons, such as above mentioned, are present, the infusoria undergo a lightning-like destruction of their molecular tissues, and become a formless sediment.

For example, a solution of 1 part of strychnine in 15,000, produces intense enlargement of the contractile sac and swelling of the body. If a drop of water containing infusoria and weighing .001 of a gramme be used as a test, the quantity of poison required to produce this effect will be .00000006. A similar effect is caused by a solution of veratrine, 1 in 8,000, the weight of alkaloid which can be detected being .00000022. Atropine influences infusoria only when 1 part is present in 1,000 of water; but even then one-1,000,000th of a gramme (one-15,000,000th of a grain) of the alkaloid can be detected. Acids and caustic alkalies act only in solutions of 1 in 400 or 600. The author says, in illustration, that if the stomach of a person poisoned by strychnine contains a liter of fluid, and only .05 of a gramme ($\frac{3}{4}$ of a grain) of the alkaloid, a single drop of the fluid will contain forty times as much strychnine as is needed for this test.

PHOTOGRAPHIC PROGRESS.—The so-called gelatino-bromide process, to which we made casual reference in our last issue, is a very substantial improvement in photography, and when certain unimportant details respecting its manipulation have been devised, the negative processes of photography will have been made practically perfect.

The new negative process which has so greatly advanced the capabilities of photography, involves the use of a gelatine emulsion of silver bromide for the light-sensitive surface. With plates of this description, photographs may be taken in a second of time which before required thirty seconds or more; and plates may be prepared so exceedingly sensitive as to require an exposure of only one-16th of a second to secure a soft and harmonious negative. The capabilities which it possesses of permitting the taking of instantaneous views under the most varied circumstances, have been abundantly tested. In our previous article we called attention to some of the remarkable results that had been attained by the use of the new process in taking instantaneous views of objects in rapid motion; but Capt. Abney mentions a case far more remarkable. In a recent lecture before the Society of Arts of London, he exhibited, in illustration of the possibilities of the new process, a photographic view in which the shadow and reflection of a swallow passing in the air over a pond were perfectly represented. In addition to their extreme sensitiveness, these plates have the quality of preserving the impressed image for a long time after they have been exposed and before it has been developed.

When a collodion emulsion is adapted to a flexible

support, the operator is enabled to dispense altogether with glass. Rolls of sensitive material may be stored in the camera itself, and the operator may as rapidly as he wishes expose fresh portions of the band. After exposure, by moistening the paper prepared with this emulsion with turpentine, the film with the image, almost free of weight and bulk, may be removed, and when it is desired to print from these negatives, they may readily be attached to glass for the purpose.

Exhibition of Electrical Appliances in Paris.—The forthcoming exhibition in Paris, designed to illustrate in the completest manner the progress that has been made in the useful applications of electricity, promises to afford the opportunity of witnessing the application of electricity for illumination on the grandest scale that has ever before been realized. All the prominent electric lighting systems will be on exhibition, and the rivalry of their respective advocates will insure that they will make the best use of their opportunity. The superintendent in charge of the arrangements announces that an engine of 800 horse-power will be provided for running the electric lights, the number of which he estimates at 600. A number of these will be in the great hall of the exhibition, others in the surrounding gardens, others in the annex (the Pavilion of the City of Paris, which was one of the wonders of the late International Exhibition, and which will be transported to the vicinity of the present exhibition building), and others in a series of saloons, which the government will fit up magnificently with tapestry work. Several electrical railways will also be in operation. The most important of these, it is reported, will be that of the Siemens Brothers, for which extensive preparations are being made. It will form a prominent feature of the British display.

We have at the present writing no advices as to the part that American exhibitors will take, though it is to be hoped they will not fail to avail themselves of so excellent an opportunity to make a creditable display of American progress in this field.

Reduction of Silver in Charcoal.—Dr. C. F. Chandler mentions the following interesting item in connection with the reduction of a silver salt by glowing charcoal. When solid nitrate of silver is placed upon glowing charcoal, deflagration takes place, the result being that the silver is left behind in the metallic state. Dr. Chandler has noticed a curious phenomenon attending this reduction—namely, that the nitrate in being fused by the heat, sinks into the pores of the charcoal, and as each particle of the latter is replaced by the reduced silver, the structure of the original wood is retained. Dr. Chandler affirms that in this way he has succeeded in producing masses of silver weighing an ounce or more, which show most beautifully the rings of annual growth of the wood. In performing the experiment, the author recommends that a crystal of the nitrate be placed on the end of a stick of charcoal, and the blow-pipe flame be directed upon the coal beside it, to start the reaction. As soon as deflagration sets in crystal after crystal of the nitrate may be added.

A New Process of Tanning, in which mineral compounds alone are employed, and bark entirely dispensed with, is said to have been extensively introduced in Germany. It has lately been experimentally tried in Glasgow (Scotland), and, it is said, with favorable results. The principle of the new process appears to be based on the well-known action of chromic acid in rendering gelatine insoluble; and the process involves the employment of a number of substances, all soluble in water, which have the power to effect the decomposition of bichromate of potassa, with the liberation of chromic acid. Specific details are wanting. The new process, it is further asserted, requires only from four to six weeks for its completion, as compared with the several months required by the usual process with bark. A number of processes for tanning with mineral substances have been suggested and employed, but none thus far have proven fully satisfactory. The above named procedure may possibly meet the requirements of the art more satisfactorily than its predecessors.

The Callograph is the name given to an apparatus or method of Herr R. Jacobsen, of Berlin, designed for the purpose of producing or multiplying copies of letters, etc. This method has, according to description, the advantage over the hektograph and other duplicating apparatus, that it will afford a greater number of impressions, and that these impressions can be made in printer's ink, which last property permits of the sending of such copies through the post office at the cheap rates charged for printed matter. The printing plate of the callograph consists of a mixture of gelatine and glycerine, to which an addition of soap is made. Before using the plate, it is moistened with a mixture consisting of tannin and glycerine, which produces a species of tanning of the surface of the plate. The original to be copied is written with a greasy ink similar to that used in lithography, and is transferred to the plate. The inked portions of the prepared printing surface take printer's ink, like the lithographic stone, while the other parts of the moistened surface reject it.

Antarctic Exploration.—While the energy of modern explorers has greatly extended our knowledge of the geography of the North Polar regions, comparatively little has been done in the exploration of the corresponding portions of the southern hemisphere. Lieut. Wilkes, at the head of an American expedition, believed that he had established the existence of an Antarctic continent, and this discovery was verified a year later by Sir James Ross, who found the extensive Victoria Land with mountains 14,000 feet high, and an active volcano. Beyond these discoveries, nothing is positively known of these extensive regions of the earth.

It is now proposed by the Italian Geographical Society to send out an Antarctic exploring expedition under the command of Lieut. Beve, an Italian officer, who accompanied Prof. Nordenskjöld in his recent Polar voyage. The expedition of Lieut. Beve, it is given out, will be fitted out for a prolonged voyage, and it is announced to be the intention of the voyagers to winter in the Antarctic region for the purpose of making a thorough study of its character.

Chian Turpentine as a Remedy for Cancer.—Some time ago, on the strength of a series of trials of this substance in one of the London hospitals, it was announced that Chian turpentine was a specific for cancer, and the new remedy was hailed with much enthusiasm by the medical profession everywhere, as this terrible disease had hitherto defied every mode of treatment. It now appears as if the great expectations formed respecting it would be doomed to disappointment, as doubts are being freely expressed in high official quarters respecting its efficacy. We append an extract from the *Lancet*, which is one of several similar items which we have lately met with: "At a recent meeting of the Medical Committee of the Middlesex Hospital, London, it was resolved that no more Chian turpentine should be ordered for the treatment of cancer, as after a prolonged and careful trial it had been found that its results were perfectly negative."

The Gain in Weight by Combustion can be very prettily shown by the following method, which also affords a very good lecture experiment: A handful of fine zinc turnings is placed on the scale-pan of a common balance, which should then be brought into equilibrium by placing weights on the other scale-pan. Now apply a spirit lamp or Bunsen burner to the zinc, which, in its state of fine division, will readily inflame. As it is slowly converted to a cohesive mass of oxide, the scale-pan will descend, showing that in burning it has gained in weight.

Polarization of Sound.—Prof. S. W. Robinson, of the Ohio State University, has lately succeeded in polarizing sound waves. This was anticipated some six years ago, and apparatus made for experimental verification. Last spring the verifying experiments were made by Mr. C. H. Wright, under the direction of Prof. Robinson, establishing the fact of polarization beyond dispute. The vibrations in sound waves are known to be longitudinal, and the fact of their polarization will materially modify the theory of vibration in light, they heretofore being accepted by authority generally as transversal. But if longitudinal vibrations in sound are polarizable, luminous vibrations are therefore probably longitudinal only.

Combustibility of Iron.—The late Prof. Magnus, of Berlin, devised the following beautiful experiment for showing the combustibility of iron: The pole of a good sized magnet is approached to a mass of iron filings, a bunch of which readily attaches itself thereto. In this condition, being not only in a highly comminuted state, but carrying a large quantity of air mechanically entangled in the loosely aggregated mass, the iron is in so favorable a condition for combustion that the approach of an ordinary spirit lamp is sufficient to inflame it, when it burns readily like any ordinary combustible. By waving the magnet to and fro a brilliant effect is produced from the showers of sparks thrown off from the burning metal.

Phosphate Deposits in Russia.—It is reported that the results of recent geological explorations made in Russia, have shown that there exist in that empire phosphate deposits of sufficient magnitude to supply the wants of Europe for an indefinite period.

Engineers' Club of Philadelphia.

At a late meeting of the Engineers' Club of Philadelphia, Mr. Charles A. Ashburner, chairman of the Committee on Information, presented a paper upon the progress and methods of the Pennsylvania State Geological Survey. Forty-eight counties have been entirely completed, eighteen partially surveyed, and seven remain to be surveyed. The Board of Commissioners estimate that it will require three years to complete the survey of the entire State. He also read notes on mine topography, in which a new method was proposed for determining the area of the available coal in the anthracite region, and cited an instance in which the hypothesis of the method had been sustained by after developments. He also exhibited a complete set of specimens of the crude and refined petroleums from Baku, Galicia and other European fields, recently received through Hon. Lewis Emery. He also presented a paper, by Col. James Worrall, a member of the club, upon the routes and methods which have been proposed for crossing the Isthmus. The Panama, Nicaragua and Tehuantepec canal routes and the ship railroad of Captain Eads, were treated, forming a paper too comprehensive to be fairly treated in a short abstract.

Mr. T. M. Cleemann read a paper on the strength of wrought iron columns, showing that the accepted formula of Rankine and Gordon gives imperfect results, and urging the necessity of further experiments on various shapes, in order to complete and render it more exact. Prof. L. M. Haupt read a paper on intercommunication in cities, showing the great value of increased facilities of travel, and applied them specially to Philadelphia. The number of persons using the horse-cars during the last year was about one hundred million, and the value of a saving of one mile in distance, and its equivalent in time and power, was computed upon this basis, with some surprising results. The paper was limited to a consideration of the street system only, the railroad system being reserved for the future. The paper contained some valuable suggestions as to important proposed improvements.

Mr. Henry G. Morris exhibited a photograph of a machine designed by Mr. Wm. S. Auchincloss, which, it is claimed, will solve problems in alligation, direct and inverse proportion, right angled triangles, circles, ellipses, square root, speed of shafting, diameter of pulleys, etc.

The Cornice Machine Litigation—Fischer vs. Hayes.

The details of the somewhat singular contest between Valentine Fischer, of the firm of Fischer & Bros., and George Hayes, the well-known skylight manufacturer, both of this city, have already been presented in our columns, and are no doubt fresh in the memory of many of our readers. On the 26th day of January last, His Honor Judge Blatchford rendered a decision in favor of the complainant, Valentine Fischer, and on the 1st of February the decree was filed in the case, sustaining the patent and decreeing perpetual injunction and costs, and an accounting for profits and damages to the complainant.

Besides the direct issue in this case, there have been various side issues, to one of which we have referred in our published accounts, known by those acquainted with the details in this matter as the "contempt suit." In this a decision has also been recently reached, by which Mr. Hayes has been again ordered to pay costs amounting to over $1,400. We understand, however, that the money has not yet been paid.

We have received the following letter from Mr. Hayes, which will no doubt be read with great interest. Since there is a still higher court to which this matter can be appealed, and as Mr. Hayes expresses a determination to carry the case up, it is evident that the final decision has not yet been reached:

To the Editor of the Manufacturer and Builder:

In accordance with your request, and that your readers may become more fully acquainted with the status of a litigation of so much importance to metal-workers, I desire, and at the same time regret, to inform them that the decision of Mr. Justice Blatchford

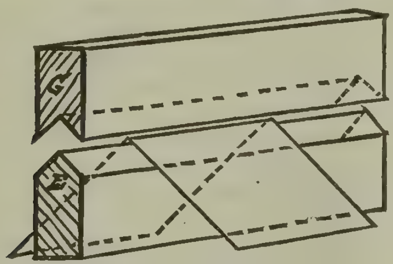


Fig. 1.—The Dies Arranged as Patented.

has been rendered adversely to the defense; but as we feel that His Honor has committed an error which renders it highly essential to the public interests that an appeal should be made therefrom to the Supreme Court of the United States, I have determined upon this course for final adjudication.

The decision is one of vital importance to the manufacturing public, as it promulgates a very injurious and dangerous precedent, and, upon appeal, there can be no doubt that the error will be corrected, for there are several cases almost identical with this that have been so corrected.

In order that the question shall be fully and properly understood, I have endeavored to put the facts in the case in a plain and straightforward manner, which, I think, cannot fail to elicit from the public a justification of my course, which I submit, in the hope that I may hear through your valuable medium what my co-workers in this great and progressive age have to say. In fact, I do appeal to them as a matter of right, for it has always been my endeavor to advance the state of the art in which they are directly associated, and how far I have succeeded your readers well know.

The whole thing is here in a nutshell, though it has been twelve long years in controversy, and has cost many thousands of dollars to litigate (and, as compared with other means for the same purpose, is not worth a dollar), and must now be carried at great expense to a higher tribunal for final adjudication.

There are two claims in the Fischer patent which have been sustained—Nos. 2 and 4—both of equal merit as an invention, but, as nobody conflicts with the second claim, I shall only treat of the fourth. I shall not touch upon any of the legal aspects of the case, so far as our alleged anticipations or the merits are concerned. I shall only submit the question of invention and the right of Mr. Fischer thereto.

The accompanying diagrams and description contain, in an honest and full manner, the gist of the entire contention: Fig. 1 shows the patented arrangement of dies as claimed by Mr. Fischer in his patent, dated February 4, 1868, and numbered 74,068. The specification in said patent reads: "The male or stationary die is underneath the female or movable die,

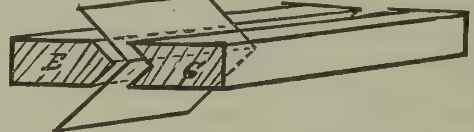


Fig. 2.—The Dies Arranged for Horizontal Movement.

for the purpose of preventing the latter from being clogged or made imperfect by dirt or other foreign matter;" and is thus claimed in said fourth claim of patent: "Arranging the female die G above the male die E, for the purpose of keeping the female die clear, as set forth."

It is claimed that by this arrangement a new result has been attained, namely, that of the dies clearing themselves of dirt, scales or other foreign substances. Bear in mind that the dies themselves are not claimed, but admitted and proven to be old and public property. The whole question then comes to this: Has a new result been accomplished? What has Mr. Fischer invented to entitle him to the monopoly of such a device when applied to the bending of cornice moldings or the forming of sheet metal for any purpose extending to my uses—namely, exclusively that of forming skylight bars and skylight frames, not embodied in the verbiage or the meaning or intention of his patent; for at the time of taking out this patent, Fischer had never heard of the uses to which I afterward applied his so-called invention. Let us see:

Figs. 2 and 3 show the identical dies as in the Fischer patent, as bending the same piece of sheet metal as in Fig. 1, only that instead of being arranged to operate female above male, as claimed in said patent, Fig. 2 shows them working horizontally; it matters not which die is stationary or which movable. Fig. 3 shows the dies as working vertically; either or both may be propelled to each other, and nothing can be more clear than that the same result precisely as that claimed by Fischer is accomplished by using the die shown in Figs. 2 and 3; to wit, "the purpose of keeping the female die clear, as set forth."

Let us here ask ourselves, "Where is the invention?" The answer of all intelligent mechanics must

Fig. 3.—The Dies Arranged for Vertical Movement.

be, "Why, there is none whatever," and the state of the art at the time of this alleged invention did not justify such a barrier to our industrial progress, and thus clog its wheels, and the result of such a sad error demands its speedy correction. Again, Fig. 4 shows the identical dies as in Fig. 1, but reversely arranged, which arrangement I and my co-defendants have substituted for that described in said patent, in obeyance of the injunctive order of the court. This arrangement does not conflict with the Fischer patent, because the female die G is below the male die E, and is equally advantageous to us in the process of bending or forming sheet metal for the various uses, and in many instances it is even preferable. It is ridiculous to presume that dirt, scale or other foreign substance will ever interfere with the die or mar the work in the process of forming sheet metal moldings, etc., which are never formed of material that will scale to such an extent as to be at all inconvenient; the continuous change of the dies, if there were any scale, which is necessary in bending a variety of forms, would obviate this.

The invention of Fischer was not in the arrangement of the dies, but in the subterfuge he discovered whereby he deceived the Commissioner of Patents and also His Honor Judge Blatchford.

Now, I appeal to the trade, with all deference to the opinion of His Honor Judge Blatchford, which of course was rendered in the public interest, and I feel that no one will appreciate my endeavors to correct an error, if there be one, more than he will himself. It is my belief that had the matter been brought before His Honor in an honest and just proceeding, a very different result would have been obtained. Along with other things, I have been embarrassed and placed in a false position by the conduct of some of those I engaged to assist me. As to the inefficiency of counsel employed by me, at a certain stage of the proceedings, and in open court, His Honor Judge Blatchford remarked, that "the defendant, though ably represented by his present counsel (James H. Whitelegge), must be held responsible for the ignorance of his former counsel." I have been so held by being under the stigma of a sentence of fine or committal for nearly one year, and have been deprived of large sums of money in consequence. All I want is, that if a wrong has

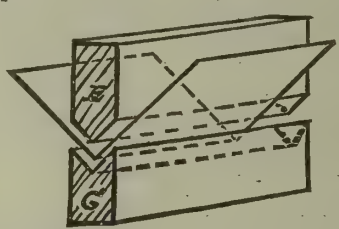


Fig. 4.—Dies Reversed from Position Shown in Fig. 1.

been done myself and others, it must be put right, and to that end only shall I direct my energies.

The following well-known and indisputable facts will not enhance Mr. Fischer's claims as an inventor; but they are true, and will have their weight with the public, nevertheless, as they have had in influencing me in the course I have pursued.

At the works of Mr. Seeley, in New York, many years prior to the alleged invention of Fischer, the latter frequently visited for the purpose of having sheet metal bent, and this was done on a machine made by Mr. Seeley, which is identical with that as claimed in the seventh claim of the Fischer patent; it is constructed with a reciprocating carriage, operated by means of a series of toggle joints, one of the oldest and best known mechanical movements. The machine, however, though claimed in said patent, does not enter into this controversy. This machine has been in the possession of Noyes & Wines for twenty years. There was put in evidence a model of a machine built by Moreton, Poole & Co. in 1851. Of this machine, our expert, the well-known Mr. H. B. Renwick, testifies as follows:

Q. Please state if you find therein the substantial embodiment of the invention covered by the fourth claim of the Fischer patent, and if so, state where the same is to be found or appears in said model.

A. I find in the model referred to in the question, the invention described in the Fischer patent and described in the fourth claim thereof; this model contains a set of lower dies, instead of a single lower die, as described and represented in the Fischer patent, and may be said truly, as each lower die is separably movable, and as each lower die is a male die, to represent several Fischer machines placed side by side; I do not understand that the Fischer machine, so far as

the fourth claim is concerned, is limited to the use of a single die, nor to the precise shape of the lower male die, so long as this die is so shaped as not to hold dirt in hollows in the working faces thereof, and so long as any dirt which may be left on each die can slide off, and thus not obstruct the operation of the machine. In the model referred to in the question, the lower dies have spaces between them through which scale from the metal, if it ever detached itself, could drop, and the construction of the machine proves that it was supposed that scale or dirt would fall, because there are gutters below the space between the dies which can serve no other purpose than to protect the working shaft from dirt falling through this open space between the dies. If the machine which this model represents was made subsequent to the date of the Fischer patent, I should find that it contained the subject matter of the fourth claim, and that the building, sale or use of it would involve an infringement of that fourth claim; if it was made prior to the date of the Fischer patent, I should say that it anticipated his fourth claim, because it contains the arrangement referred to in that claim, so organized in the machines that the benefit resulting from the use of that arrangement would be obtained by the use of the machine.

This testimony stands alone, and no attempt was made to contradict it.

Again, Mr. W. E. Worthen, one of the most celebrated civil and mechanical engineers in the United States, testifies:

Q. Which die, the male or female, was uppermost in the machines you have testified to, and when bending galvanized sheet iron?

A. Sometimes the female was above, and sometimes the male, according to the requirements of the work, and convenience.

. . . .

Q. When putting in, or when desiring to form an angle bend with a single pair of dies located and adjusted in the machine or machines to which you have testified, where did you place the sheet-iron to receive its form or angle?

A. We place it on the lower dies. On the male die when used as in defendant's Exhibit C and D.

. . . .

Q. State then what you know with respect to the alleged invention of Fischer as described in said letters-patent, as to the fourth claim therein.

A. I have placed the female die above the male die, and have so used the machine for the purpose of making cornices, long anterior to the date of this patent.

Q. How long anterior?

A. Certainly eight years.

Again, the machine which was the subject of the litigation, Fischer vs. Wilson, *et al.*, was imported into this country from London, England, at least one year before the patent of Fischer was issued. This fact, however, did not avail for the defence, as the law prescribes that public use, in order to invalidate a patent, must be at least in use two years prior within the United States.

The method of bending moldings in England, to my own positive knowledge, for at least thirty years, has been identically that as now monopolized by Fischer. I distinctly remember a machine that was built by Rhodes & Son, of Leeds, in Yorkshire, being in my father's workshop at least thirty years ago. This was the common method of bending sheet metal at that time, and I ask, Must we admit that we are so unenlightened in the state of the art as to make or recognize as a benefactor this Mr. Fischer for inventing such a process at so recent a period as 1868? I think not.

It is a fact that Fischer never made but one machine under his patent, and that machine has been kept in seclusion so far as the public are concerned, and used exclusively by him in his own workshop, and all persons applying to him to see it, or for permission to use it (the device embodied in it), have been refused that privilege, so that the intent and meaning of the grant of exclusive right under letters-patent have been frustrated and the public deceived by its own act.

I am, respectfully yours, GEO. HAYES.

New York, February 2, 1881.

Although the device over which this contest is being fought is of very little practical value to metal-workers, there is perhaps more involved in it than many of our readers would think at first sight. Some twenty-five machines of the kind in question are now in use, only a very small number of the owners of which have made terms with the patentee and complainant in this suit. The others are left to settle or to fight, as to them seems best. Among the names of the parties using this machine, and whose interests are affected by this decision, we notice the following: Knisley & Co., Chicago, Ill.; J. S. Thorn, Philadelphia, Pa.; Star & Leadley, Camden, N. J.; A. C. Dunlevy, St. Louis, Mo.; John G. Hetzel, Baltimore, Md.; John Smith, Kansas City, Mo.; Tucker & Brighing, San Francisco, Cal.; —— Hicks, San Francisco, Cal.; Wasson & Martin, Albany, N. Y.; John Nicholson, New York City; John D. Ottiwell, New York City; Shaunnessey & Simpson, New York City; John Neil, New York City; Bickelhaupt Bros., New York City; John Borkel, New York City; Metallic Burial Case Co., 406 Pearl street, New York; John Seton, Brooklyn, N. Y.

We understand that suits against some of these parties have already been instituted, and that others are contemplated upon the part of the complainant.

With reference to the letter published above, we desire to say that Mr. Hayes is a representative man of great genius, having devised many useful and important inventions; among the most prominent of the latter have been his improvements in skylights, the present perfection of which is due more largely to him perhaps than to any other inventor. Our business acquaintance with Mr. Hayes has extended over a period of ten years, and we know him to be thoroughly honest in his defense of what he terms a most unjust decision, and with all the respect that is due to the opinion of Judge Blatchford, we are pleased to learn that Mr. Hayes has determined to carry his case to the United States Supreme Court, where we feel confident he will meet with a victory. There is no doubt that Mr. Hayes could have compromised this case at different times in its progress for far less money than the costs of fighting it, and that he has continued in the fight so long upon principle, rather than upon any expectation of gain, attests the sincerity of his course. He believes that there is a principle at stake worth fighting for, not alone for himself, but for the public. We wish him success.

Introduction of the Carp as a Food Fish.

The United States Fish Commission, which is doing a vast amount of good in increasing the food supplies of the country by stocking the rivers and other streams with food fishes, has lately turned its attention to the introduction of the carp, which is looked upon as a step of great importance. Prof. Baird, the Chief of the Commission, expresses great faith in the future value of this fish to the country. It is but little known or valued in England and France, but in Germany and Austria it is carefully cultivated, and constitutes a notable portion of the food supply.

The carp is supposed to be of Asiatic origin, and has been cultivated in China from time immemorial. It has, however, been so long domesticated in Europe that it has come to be considered a native fish. Prof. Baird, speaking of it, says it is emphatically a farmer's fish, and may safely be claimed to be among fishes what chickens are among birds, and pigs and ruminants among animals.

Its special merits lie in its sluggish habits and the ease with which it can be kept in limited enclosures, where almost every other species of fish would die; the fact of its being a vegetable feeder, thriving upon roots and leaves of aquatic growth, seeds, corn, grain bread, and vegetable refuse generally; and its remarkable rate of growth. On this last point, it is said that the growth of the specimens introduced into this country is even more remarkable than in Europe. Among the original fish imported by the Fish Commission from Europe, and which are now only about three and a half years old, there are some which have attained a length of from 25 to 30 inches, and a weight of 8 or 9 pounds.

The Fish Commission look upon the introduction of the carp in this country as of great importance, and since the first establishment of the national carp ponds at Washington, many thousands of young fish have been distributed for stocking suitable waters throughout the country. Persons desiring fish for this purpose, will be supplied on application to Prof. S. F. Baird, United States Fish Commission, Washington, D. C., who will likewise furnish all necessary information respecting the best means of caring for and cultivating them.

Since writing the above, we learn with regret that the government carp ponds were flooded in the disastrous inundation that lately occurred at Washington.

Removal of Stains and Spots.

Stearine.—In all cases, strong pure alcohol.

Gum, Sugar, Jelly, etc.—Simple washing with water at a hand heat.

Matter Adhering Mechanically.—Beating, brushing, and currents of water either on the upper or under side.

Lime and Alkalies.—White goods, simple washing. Colored cottons, woolens and silks are moistened, and very dilute citric acid is applied with the finger end.

Alizarine Inks.—White goods, tartaric acid, the more concentrated the older the spots. On colored cottons and woolens, and on silks, dilute tartaric acid is applied cautiously.

Scorching.—White goods, rub well with linen rags dipped in chlorine water. Colored cottons, re-dye if possible; or in woolens raise a fresh surface. Silks, no remedy.

Oil Colors, Varnish and Resins.—On white or colored linens, cottons or woolens, use rectified oil of turpentine, alcohol, lye and then soap; on silks, use benzine, ether, and mild soap, very cautiously.

Vegetable Colors, Fruit, Red Wine, and Red Ink.—On white goods, sulphur fumes or chlorine water; colored cottons and woolens, wash with lukewarm soap, lye or ammonia; silk, the same, but more cautiously.

Iron Spots and Black Ink.—White goods, hot oxalic acid, dilute muriatic acid, with little fragments of tin. On fast-dyed cottons and woolens, citric acid is cautiously and repeatedly applied. Silks, impossible.

Blood and Albuminoid Matters.—Steeping in lukewarm water. If pepsine, or the juice of *Carica papaya*, can be procured, the spots are first softened with lukewarm water, and then either of these substances is applied.

Grease.—White goods, wash with soap or alkaline lyes; colored cottons, wash with lukewarm soap lyes; colored woolens, the same, or ammonia; silks, absorb with French chalk or fuller's earth, and dissolve away with benzine or ether.

Tanning from Chestnuts, Green Walnuts, etc., or Leather.—White goods, hot chlorine water and concentrated tartaric acid. Colored cottons, woolens and silks, apply dilute chlorine water cautiously to the spot, washing it away and reapplying it several times.

Tar, Cart-Wheel Grease, Mixtures of Fat, Resin, Carbon and Acetic Acid.—On white goods, soap and oil of turpentine, alternating with streams of water. Colored cottons and woolens, rub in with lard and let lie, soap and let lie again, and treat alternately with oil of turpentine and water. Silks, the same, but more carefully, using benzine instead of oil of turpentine.

Acids, Vinegar, Sour Wine, Must, and Sour Fruits.—White goods, simple washing, followed up by chlorine water. Colored cottons, woolens and silks are very carefully moistened with dilute ammonia with the finger end. In case of delicate colors, it will be found preferable to make some prepared chalk into a thin paste with water, and apply it to the spots.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	25 a 28
Spruce plank, 2-inch	38 a — 40
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	50 00 a — —
Oak	55 00 a 66 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a 100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 10 a — —
Yellow dressed pine flooring	30 00 a 37 50
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	4 00	a 4 50
Up Rivers	— —	a — —
Jersey	8 00	a — —
Long Island	9 00	a — —
Staten Island	8 50	a 8 75
Haverstraw Bay	— —	a — —
" " choice	— —	a — —
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown, per M.	10 50 a 11 00
" Dark	11 00 a 12 00
" Red	11 00 a 12 00
Philadelphia	— — a — —
Trenton	21 00 a 22 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	24 50 a — —
" Glengarnock	23 00 a 23 50
" Eglinton	22 00 a 22 50
" American, No. 1	25 00 a 26 00
" American, No. 2	22 00 a 23 00
" American, forge	20 00 a 21 00
	Store prices. Cash.
Bar, Swedes, ordinary sizes	— 6 a — 6¾
Bar, Swedes, nail-rod	— 6½ a — —

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1¼ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 50 a 5 75

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7¼ a — 8
Sheet, (open)	— 7½ a — 7⅝

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a — —
do do No. 1, blue, in rough	— 85 a — 90
Bedford Stone	1 00 a — —
Berlin Freestone, in rough	— 85 a — 90
Berea Freestone, in rough	— 75 a — —
Brown Stone, Portland, Conn	1 05 a 1 30
Bay of Fundy Wood Point Brown Stone	1 00 a — —
do Mary Point Brown Stone	1 00 a — —
do do Olive Stone	1 00 a — —
Brown Stone, Belleville, N. J	1 25 a 1 75
Granite, rough	— 75 a 1 00
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a — —

PAINTS.

*Carmine, American, per lb ... gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton ... gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7¼ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil ... gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English ... gold	— 9 a — 10
Paris White, American	— 1¼ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags ... gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) ... gold	— 8¼ a — 9
Zinc, white French, in oil ... gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 25
Portland (American)	2 25 a 2 50
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 65 a 3 80
Portland (German, Bonner)	2 85 a 3 25
Lime of Teil	2 20 a 2 30
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 15 a 1 25

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 00
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 25 a — —
Calcined, city casting	1 50 a — —
Calcined, city superfine	1 75 a — —

LIME—PER BARREL.

State, common	— 90 a — —
" finishing	1 15 a 1 25
Rockland, common, cargo rate	1 00 a — —
" finishing	1 25 a — —
Ground	— 95 a 1 00

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 29
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2¼ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2¼ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 25
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 20 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	1 75 a 2 00
Masons, do	2 75 a 3 00
Plasterers, do	3 00 a — —
Carpenters, do	2 75 a 3 00
Plumbers, do	2 50 a 3 00
Painters, do	2 50 a — —
Stone-Setters, do	2 75 a 3 00

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 84	——
2.6 x 6.6	1¼	1 18	——
2.6 x 6.8	1¼	1 24	——
2.8 x 6.8	1¾	1 30	——

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 54	——	——
2.6 x 6.6	1 90	2 41	——
2.6 x 6.8	1 96	2 43	——
2.6 x 6.10	1 98	2 51	——
2.6 x 7.0	2 02	2 61	——
3.8 x 6.8	2 02	2 61	3 25
2.8 x 7.0	2 11	2 71	3 35
2.10 x 6.10	2 23	2 82	3 50
2.0 x 7.0	2 33	3 06	3 75

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	25 a —
Up to 3.1 wide	27 a —
Up to 3.4 wide	30 a —

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	56 a — —
Per lineal foot, 4 folds, ash or chestnut	— 90 a — —
Per lineal foot, 4 folds, cherry or butternut	1 07 a — —
Per lineal foot, 4 folds, black walnut	1 30 a — —

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 a — —

REVIEW OF THE MARKETS.—In the lumber market demand has not improved to any considerable extent during the past month, but some evidences of a gradual growth have been noticeable, and in most cases we have found continued expressions of confidence and cheerful expectation over the prospects for the spring trade. Consumption on city account and at near-by points will require liberal quantities of material and a very general assortment.

In the brick market affairs have not assumed any definite shape as yet, but there has been a better basis formed to work upon, and the prospect ahead is exceedingly flattering. The wants of work now in hand will require all the brick likely to come within reach until navigation is open, and the milder weather will so add to consumption as to largely offset any accumulation wintered over at primary points.

In the lath market distribution has been on the increase, and under a heavy stock trade has developed all the strength claimed for it by holders.

In the lime market the position has been firm, with demand for all, and even more, material than has come to hand.

In the hardware market demand has been quite irregular, especially from interior sources, and in a great measure has been dependent upon opportunities for securing transportation. All advices at hand indicate, however, that the wants of the trade will be full, and as the local consumption is quite likely to require large amounts of stock, dealers consider the outlook as very promising on all standard descriptions of hardware. Some irregularity on prices may be noted, but in general manufacturers and agents preserve a fairly steady tone; and on pretty much all goods the regular lists and discounts are closely adhered to.

In the paint market trade has not been very active, but indications have steadily grown more promising, with the undertone cheerful and confident.

In the metal markets American pig has been dull, although no sign of weakness has been shown. Scotch pig has sold fairly, but trade has been devoid of anything like animation. Manufactured iron has been dull, with weaker prices and small demand. In tin there has been no material change, and the market closes firm. Lead has been dull, but prices have remained steady, and there seems to be a feeling that the early spring may stiffen prices.

TO TEST THE QUALITY OF GLUE.—Dry glue steeped in cold water absorbs different quantities of water, according to the quality of the glue, while the proportion of the water so absorbed may be used as a test of the quality of the glue. From careful experiments with dry glue immersed for twenty-four hours in water, at 60° Fah., and thereby transformed into a jelly, it was found that the finest ordinary glue, or that made from white bones, absorbs twelve times its weight of water in twenty-four hours; from dark bones, the glue absorbs nine times its weight of water, while the ordinary glue, made from animal refuse, absorbs but three to five times its weight of water.

Home Department.

Remington Sewing Machine.

The great perfection to which the mechanic arts have been brought, is probably best illustrated by the sewing machine. It has offered the most inviting field for the exercise of the ingenuity of inventors, and they have availed themselves of the opportunity so fully

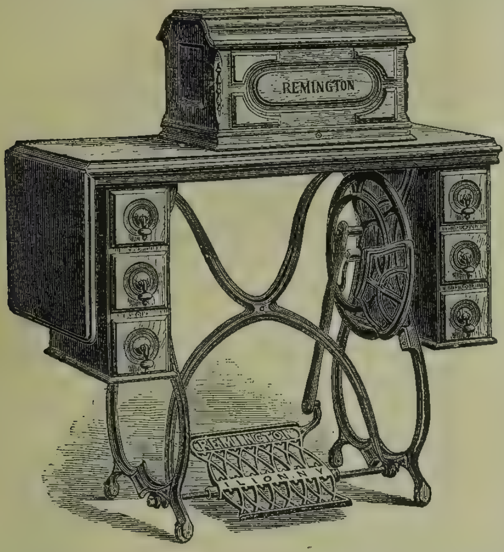


Fig. 1.—Remington Sewing Machine—Half Cabinet.

that any substantial improvement on the machine as it now stands appears highly improbable.

We represent in the accompanying illustrations one of the best known and most popular of these indispensable adjuncts of the modern household—the Remington sewing machine, manufactured by E. Remington & Sons, of Ilion, N. Y. This machine embodies in its construction many admirable qualities, and has become justly popular as a domestic machine, which ranks second to none of its competitors in ease of running and management, durability and great range of work. The makers supply it with all the usual, and some unusual, contrivances to increase its usefulness, and it will be found to meet all requirements.

Of our engravings Fig. 1 represents one of the many styles of the Remington machine. The new Remington hand sewing machine, shown in Fig. 2, is made specially for the export trade, and has, it is claimed, fewer parts and does a greater range of work than any other. Fig. 3 shows a quilting attachment that can be applied to any of the Remington machines.

The offices of the company are at 281 and 283 Broadway, this city.

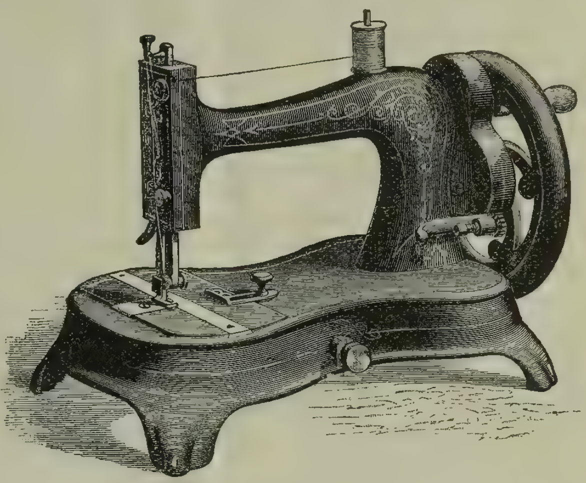


Fig. 2.—Hand Sewing Machine.

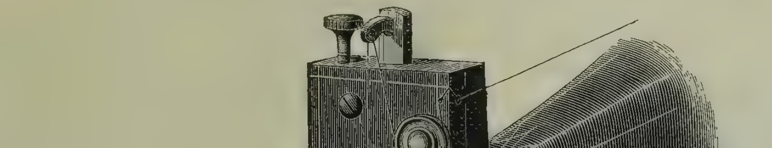


Fig. 3.—QUILTING ATTACHMENT.

Heating by Overhead Pipes.

The Boston Mutual Manufacturers' Fire Insurance Company, after meeting much theoretical and some practical opposition to their scheme of overhead heating pipes, have the satisfaction of receiving strong commendations of the plan by a large number of mills where its merits have been thoroughly tested. Recently the company sent to fifty-two of their members, comprising cotton, woolen, paper and jute mills and bleacheries, which they knew to be fitted wholly or in part with overhead pipes, asking: 1st, what departments were so heated; 2d, how they were placed; 3d, if the rooms were heated satisfactorily; 4th, the relative economy in the construction of pipe service as compared to side pipes; 5th, the relative economy in use; 6th, relative amount of heat surface in use; 7th, if there were any objections to this mode of placing pipes, and what they were; and 8th, if there were any reasons for assuming that overhead pipes had better not be adopted in rooms where there was no machinery, shafting or belting in motion. To these circulars 42 replies were received, of which 2 were absolutely unfavorable; 2 were unfavorable, but qualified by the fact that the lines of pipe were single 3 or 6 inch cast iron in very low rooms; 1 was favorable, with exceptions; and 37 were absolutely favorable. Among the 10 from whom no answers had been received, there were several known to the company who would tolerate no other mode of placing pipes. In respect to economy in heating, the answers vary from nothing to 25 per cent saved; but as most mills are heated by exhaust steam, the company did not expect very definite replies on this point. It is pointed out, however, that the greatest economy is claimed where the pipes are hung from beams away from the wall, leading to the conclusion that radiation is more effective when the pipes are open on all sides; when hung close to the wall, a certain amount of heat must pass off through the wall.

While the company hesitate before recommending the overhead system for rooms in which there is no machinery moving to promote the circulation of the air, they still instance its use in sorting rooms in woolen and paper mills. But they do not hesitate to recommend absolutely the placing of coils of steam pipes for heating purposes overhead in all rooms in which there is even a small amount of shafting or belting in operation. They suggest only the trial of coils of pipe placed overhead in the center of rooms of which the sides are occupied by sorting benches, carpenters' or metal-workers' benches, or other appliances, even where there is no moving machinery or apparatus in the room.

Danger in the Sleeping-Room.—In fighting that terrible enemy, sewer gas, it will not do to depend on the plumber. In sleeping-rooms the siphonage of the trap is the opening of the gate of death; and yet, strange to say, thousands of people hear nightly this death-rattle in their rooms, and do not know what it means. Now, if one cannot have effective plumbing, the next best thing is to know what to do about it. As siphonage implies the breaking of the water-seal that acts as a barrier against the free admission of sewer gas, it is, first of all, important to know what traps are defective. When one hears a low, gurgling sound in the wash-basin, the time for action has come. Any noise beneath the wash-basin, at any hour of the day or night, when the water is not turned on, means death. The gurgling sound is caused by a draft of air down the escape pipe, which breaks the water-seals. Of course the services of the best plumber should be had at once; but in the meantime fight the enemy. First turn on water and fill the trap; then put in the plug, fill the basin half full of water, and with wax or soap seal up the overflow holes. Lower a window and let in the outer air. Until the sound of siphonage ceases, and you are absolutely certain that the trap can be relied on, stand guard over it. Keep the overflow holes sealed and the plug in, no matter at what risk of flooding lower rooms, in case some one is thoughtless enough to leave water turned on. If every family would act on these hints, we would have less diphtheria.

Glycerine for Acidity of the Stomach.

A late number of the Boston *Journal of Chemistry* reprinted from the London *Lancet* Dr. Ringer's article upon the use of glycerine in flatulence, acidity and pyrosis. Dr. J. A. Lewis, referring to the same article, in a communication to the Louisville *Medical News*, says:

"I desire to add my testimony to its value, so far as regards acidity and flatulence. For this form of indigestion, so common, and for the relief of which so many persons resort to the daily use of soda, glycerine is a remedial agent of no mean value. I have used it for several months with my patients troubled in this way, and in a majority of cases the results have been gratifying. I had no knowledge of its use for dyspeptic troubles, and was led to the use of it much in the same way as reported by Mr. Ringer. I knew of its property of preventing fermentation, and especially of its use by druggists in preserving their syrups from acidity. I was led to a trial of it upon this principle, and soon became satisfied of its real value. I have always prescribed it in large doses, never less than two teaspoonfuls to a tablespoonful for an adult, to be taken in a wineglass of water immediately after eating. It does no good after fermentation of the food has taken place in the stom-

ach. It is no specific—no cure-all, but certainly does afford alleviation, if not a cure, in many of these cases, and is worthy of a place among the remedies in use for this very common ill of the flesh.

A School for Plumbers to be Opened in New York.

The popular interest now prevailing in the subject of domestic drainage has led to the inception of a course of technical instruction in plumbing and sanitary engineering, which will be given at the rooms of the Metropolitan Museum of Art, New York. The course of lectures, which will be given on Monday and Wednesday evenings, will cover a period of two months. The course will embrace lectures by Professor Chas. F. Chandler, on the "Chemistry of Sewer Gas, Disinfectants," etc.; by Mr. C. F. Wingate, of the *Sanitary Engineer*, on "Plumbing," and by Mr. John Buckingham, on "Mechanical Drawing." The following list of subjects will give an idea of the value of this course to practical plumbers: "Sources of Water Supply and Means of Conveyance," "Systems of Sewerage and Sewage Disposal," "Laws of Physics and Hydrostatics," "Chemistry of Sewer Gas," "Disinfectants and Deodorizers," "Water Pollution and Water Analysis," "Plumbing Materials," "Proper and Defective Methods of Plumbing," "Various Apparatus and Appliances Used in House Drainage." The lectures will be illustrated by models of various plumbing appliances and apparatus, loaned or presented by the manufacturers of such articles, and by sketches of proper and defective methods of plumbing. Professor Chandler's lectures will be illustrated by the magic lantern and electric light.

New Publications.

Education. Boston, Mass.: Thomas W. Bicknell.

The March-April number is this new bi-monthly magazine, will be, in some of its features, a very remarkable educational publication. The leading article is by Prof. Seely, of England, the distinguished author of "Ecce Homo"; it is entitled "The British Race," and shows, in a way most complimentary to Americans, that the fullest expression of the spirit of British life, education, constitution and civilization is to be found in our own country. This article, from its scholarship and bold and vigorous expression of views, will attract wide attention in all circles in England and America. Dr. W. T. Harris has an article on "The Press as an Educator," in which he exhibits not only his usual philosophic style, but a broad acquaintance with the great factors in human progress. William Jolly, an English Inspector of Schools, has an able article on "Real Education; its Principles, and a Little-Known Chapter in its History." Mr. Jolly is well known as the author of "Education; its Principles and Practice as Developed by George Combe." Mr. Lovejoy, of Washington, discusses Richard Grant White's attack on public schools, from a Southerner's standpoint; and Superintendent Luckey, of Pittsburgh, Pa., takes a North-side view of Mr. White. Dr. Fellows, of Iowa, gives a practical review of Didactics as taught in his University. Dr. Humphreys, of Boston; Dr. Gregory, of Illinois; Prof. Leighton, of Brooklyn, N. Y., and others, contribute valuable papers to this number, all of which will make it the most interesting magazine on education ever issued. The number will contain, besides this rich store of literary matter, a steel engraving of Thomas Sherwin, late Head Master of the English High School.

Pottery Decoration Under the Glaze. By M. Louise McLaughlin. Cincinnati: Robert Clarke & Co. 1880. Sq. 12mo.

In this very interesting volume Miss McLaughlin records, for the guidance of art lovers, her experiences, and gives the results of her very successful work in the field of ceramic art. The talented authoress has become widely known as the discoverer of the method of painting the celebrated Haviland or Limoges Faience, which created such an interest among art lovers at the Centennial Exhibition; and the volume here referred to gives the complete details of the process as perfected by her, after nearly three years of laborious study and experiment. The work in question will be found to be very practical. The introductory chapter on Pottery Decoration gives a complete *resumé* of all the facts and principles necessary to an understanding of the subject; and the chapters on Modeling upon Pottery, Painting upon the Biscuit, Incising and Carving in Clay, and on Colors for Painting under the Glaze, are not only very comprehensive in the extent of information they afford, but, embodying as they do the results of the actual experience and experiments of the writer, are of the utmost practical value to those intending to make this subject a specialty. Like all the publications of the Messrs. Clarke, this volume is gotten up in highly creditable style.

The United States Official Postal Guide. Boston: Houghton, Mifflin & Co. Price, in paper, $1; in cloth, $1.50.

We have received the January number of this invaluable work, and find it so replete with information that we do not see how any one can afford to be without it. The book consists of about 650 pages, and contains clear and accurate information regarding all matters connected with the postal service, classified as follows: 1. Post offices in the United States, with county and State. 2. Post offices arranged by States. 3. Post offices arranged by States and counties, with the geographical position of the counties. 4. The money-order offices, domestic and international. 5. Post offices of the first, second and third classes, with salaries. 6. Counties, and a list of letter-carrier offices. 7. Canadian money-order offices; information concerning mailable matter; full directions about money orders and registered letters; rates of foreign and domestic postage; sailing of mail steamers; latest rulings of the Post Office Department; and all other needful information about postal matters. The work can be procured of postmasters, booksellers, and newsdealers, or of the publishers.

Charcoal Drawing without a Master. A Complete Practical Treatise on Landscape Drawing in Charcoal, followed by Lessons on Studies after Allongé. Translated from the fifth edition (Karl Robert-Le Fusain) by Elizabeth Haven Appleton. Cincinnati: Robert Clarke & Co. 1880.

This work will be found to be very useful by amateur artists and others who desire to acquire this rapid, convenient and agreeable method of sketching. The method is admirably adapted for making notes of landscapes and other pictorial effects, which an artist may wish to retain for future use, for while it does not demand the sacrifice of much time, it gives prompt and satisfactory results. The work here noticed is specially designed for the instruction of beginners; and the simplest details of the art are treated of at length, with the special object of enabling the amateur to acquire the art without the aid of a master.

OTHER PUBLICATIONS RECEIVED.

Annual Report of the Chief of Ordnance to the Secretary of War, for the year ended June 30, 1880. Washington: Government Print. 1880. From Brig.-Gen. S. V. Benét, Chief of Ordnance U. S. A.

Preliminary Report of the Department of Agriculture for the year 1880. Washington: Government Print. 1881. From the Commissioner.

Summary Statement of the Imports and Exports of the United States, for the month ended November 30, 1880, and for the eleven months ended the same, compared with the corresponding periods of 1879. Prepared and published by the United States Bureau of Statistics. [Corrected to January 10, 1881].

Miscellaneous and Advertising.

The George Place Machinery Agency, of 121 Chambers street, this city, have always on hand a large line of new and second-hand machinery of every description.

W. F. & John Barnes, of Rockford, Ill., the well-known manufacturers of Barnes' foot-power scroll saw, send their machines, if desired, to parties wishing to give them a trial before purchasing.

Wallace & Sons, of Ansonia, Conn., have just ordered four hundred horse-power of Babcock & Wilcox boilers, after using 100 horse-power eighteen months and carefully testing them by the side of Harrison, tubulars, and duplex boilers.

Heald & Morris, of Baldwinsville, N. Y., manufacture vertical and horizontal pumps with a capacity of from 100 to 35,000 gallons per minute. They are simple, efficient, economical and durable, and are used by all the leading tanners and paper-makers of the country. This firm also manufacture horizontal and vertical engines, from 10 to 30 horse-power, for long-continued hard work, at extremely low prices.

The sales of the Stow Flexible Shaft Co., of Philadelphia, for 1880, were much larger than ever before, being an increase of 25 per cent over those of 1879. This company have taken into their shop the manufacture of some articles they previously had made outside, thus giving employment to a few more men, and they contemplate this year making everything themselves. They have moved during the past year into larger and more commodious quarters, and find it difficult to keep sufficient stock ahead to meet their orders.

In view of the great number of buildings in contemplation for erection this spring, it behooves builders and property owners to see that proper outside conductors are provided. To withstand the severe changes to which in this country we are subjected, it is essential that a conductor must be used that will readily allow of contraction and expansion; and such a one is Austin's patent corrugated conductor or rain-spout, manufactured by Austin, Obdyke & Co., of 1705–1725 Chestnut street, Philadelphia.

Our February Design.

Grave doubts having been expressed by a number of persons as to whether the row of buildings published in the February number of this journal, could be erected for the price there stated, an estimate has been obtained from the architects of the buildings, Smith & Howe, and is here given in substantiation of their assertion:

Excavating, 400 yards	$100 00
Foundation, stone, laid	250 00
Brick, 130,000, laid	2,080 00
Plastering, 2,000 square yards	440 00
Stone-work, set	500 00
Hemlock timber, 9,000 feet	135 00
Roofing boards, 3,300 feet	49 50
Tinning	300 00
Flooring, 10,560 feet	263 00
Windows and doors	625 00
Stairs, put up	200 00
Labor not included in above	800 00
Hardware	110 00
Painting	200 00
	$6,052 50

Design for Dwelling Costing $5,500.

The illustration on the opposite page represents a dwelling of the first class, the materials being all of the best, and of careful finish. Picturesque in appearance, and of ample size, it is well adapted to the position it holds, and would be no unworthy companion to the best houses in any town.

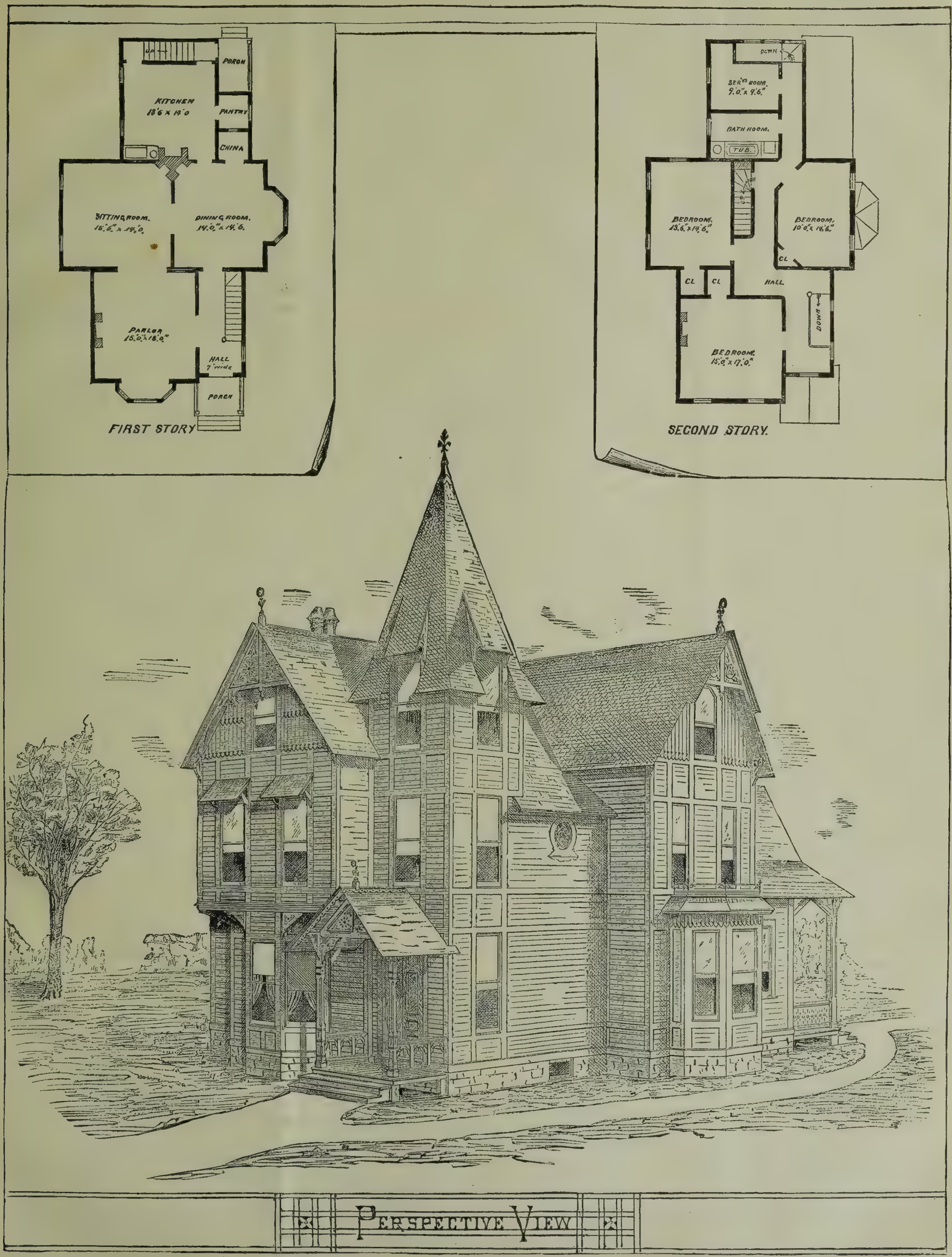
A glance at the plans will show the admirable arrangement of the rooms, all of which are of generous proportions, and provided with plenty of pantries and closets. In addition to the rooms here shown, there are in the third story extra bedrooms and servants' rooms, making the house desirable to a large family.

On the first floor there is a parlor, 15 × 18 feet; sitting-room, 14 feet by 15 feet 6 inches; dining-room, 14 × 14 feet 6 inches; and kitchen, 13 feet 6 inches by 14 feet. Off the dining-room there is a commodious china closet, and off the kitchen a pantry of good size. There is a small porch at the front and rear entrances of the house, the former leading into the main hall, which is 7 feet wide. On the second floor there are four bedrooms of the following respective dimensions: 15 by 17 feet; 13 feet 6 inches by 14 feet 6 inches; 10 feet by 14 feet 6 inches; 9 feet by 9 feet 6 inches. These rooms are all very conveniently arranged, as will be seen by the plans. On this floor there are provided a bath and water closet.

The materials used in the construction are, stone for the foundation, with the timbering of spruce, the roof being slated. In the interior the hall and dining-room are finished in ash; the parlor and sitting-room in ash, relieved by California redwood; the kitchen is finished in yellow pine.

The corner fire-place in the sitting-room and dining-room is a feature very commonly met with now; and where, as in the present case, the chimney in connection with these serves also as the chimney from the kitchen, there is a suggestion of economy in the arrangement that may indicate like care given to other details in the construction of the building.

The architects of the building are Smith & Howe, of 7 Warren street, New York.



DESIGN FOR DWELLING COSTING $5,500.

Adulterations of Food.

Abstract of a paper read before the meeting of the American Social Science Association, at Saratoga, by Professor S. W. Johnson.

(*Continued from Page 42, January Number.*)

Mustard is an article that appears to be nearly always adulterated. Not only is ordinary grocer's flour of mustard often so weak that a poultice made of it will not irritate the skin unpleasantly, but the "genuine mustard" sold by apothecaries is far from pure. The ordinary treatment which mustard receives at the hands of the "manufacturer," consists in mixing it with 20 to 50 per cent, or more, of wheat flour, and then with enough ground turmeric to restore the appropriate yellow color. Thus far the adulteration is not so serious, because the diluted mustard answers all the purposes of a condiment, or even of a poultice; but the mischief thus begun soon grows to formidable dimensions. Mustard itself, which unground may cost perhaps $5 per bushel, is largely substituted by insipid charlock seed costing but $2, cayenne and ginger being added to give it "bite." Instead of wheat flour, ground rice, plaster of Paris and pipe-clay are used to make bulk and weight, and instead of harmless turmeric, yellow ocher or even poisonous chromate of lead are employed as color.

Pepper, black and white—the former made from the entire pepper berry, and latter from the same after the external husk is removed—were formerly adulterated in the most scandalous manner. In 1851, Hassall examined forty-three London samples, nearly one-half of which were sophisticated. He found wheat flour, linseed meal, mustard husks, pea flour, rice flour, sago and pepper dust, or P. D. This last is either the sweepings of the warehouses, or an article made in imitation of ground pepper expressly for their adulteration. The chief chemist employed in the British Customs Department, stated before a Parliamentary Committee, in respect to the falsification of pepper, that out of 1,116 samples examined, 576 were adulterated. "We found, he said, "rice, sago, potato starch, linseed meal, capsicum, husks of red and of white mustard, wheat flour, bran and ground gypsum." Other adulterants have been bone dust and sawdust. Of a hundred pounds of an article seized at Chelmsford, England, as pepper, in 1852, two pounds only were pepper, the rest being mustard husks, rice and cayenne.

As long ago as 1820, Accum, a German chemist established in London, described artificial pepper-corns, which he states were made of linseed-cake, common clay and a little cayenne formed into a mass, granulated by being pressed through a sieve, afterward dried and finally smoothed by rolling in a barrel.

I can only briefly enumerate the adulterations of other condiments and spices. Cayenne is worse falsified than white and black pepper. Of 28 London samples, Hassall found only 4 that were genuine; 22 contained mineral coloring matter, 13 got their color mainly from red lead, 7 from red chalk or red ocher, and in 1 vermilion (sulphide of mercury) was present. Ground spices are not only adulterated by adding flour and starch of various kinds, but cheap cassia is substituted for costly cinnamon, and both are robbed of a good part of their flavoring principle—the valuable volatile oil. Worm-eaten and worthless nutmegs are skillfully repaired by stopping the holes with a suitably compounded cement; and not only are wooden nutmegs traditionally credited to "down East," but a distinguished Frenchman asserts that the workmen of Marseilles have fabricated false nutmegs—insipid and inodorous—out of bran, clay and the powder of nutmegs too decayed or wormy for repairs.

Tea and coffee, which involves such enormous industrial and commercial interests, have been, as every one knows, falsified on a vast scale. The adulterations of tea appear to have originated in China itself. They were at one time extensively practiced in England, but as the duty on tea was gradually reduced, the business of adulterating became less and less remunerative, until it is said to have nearly altogether ceased in that country. According to Hassall, the adulterations resorted to in China are of four classes: First, with leaves of several kinds of other plants. Second, with Lil-tea. This is an imitation of tea with most or all of the tea left out, and is compounded of various mixtures to resemble the different sorts and grades of genuine tea. Third, with mineral substances to give weight; and fourth, with pigments and "facing" to improve the color and luster of the article. When, thirty to forty years ago, high duties were exacted on teas imported into England, regular tea factories existed in London, Liverpool and other large cities—some dozen, it is believed, in all. The industry carried on in the factories, consisted partly in buying up tea-grounds at hotels and coffee-houses for two or three pence per pound, giving them a coating of gum-water, tannin and copperas, and drying; if meant for black tea, "facing" them with rose-pink and black lead; if for green tea, with Prussian blue and chrome yellow, or similar and worse pigments. Another part of the business was converting the leaves of all manner of British trees into false tea, or, as the Chinese are said to frankly designate it, *lie tea.*

In 1843, the London excise officers seized some tea containing 35 per cent of a fearful poison—carbonate of copper. In 1845, tea was confiscated at Manchester in which chromate of potash, an active poison, was used as "facing," and on the premises were found mixtures—evidently meant for "facing" tea—containing chromate of lead and arsenite of copper, the latter quite like Paris green in its effects on the animal economy.

Coffee has long been, and still is, extensively adulterated with chicory, burnt sugar, parched peas, beans, barley, rye, wheat and peanuts. Roasted carrots, potatoes, parsnips, beets, acorns, spent tan-bark, spent logwood, mahogany sawdust and baked horses' liver are some of the other substances that have been identified in the ground coffee of London. Chicory, as already remarked, has established itself as a regular ingredient of package coffee, and such coffees not infrequently contain little else besides chicory and roasted grain or vegetable of some sort. In 1850, Messrs. Duckworth, of Liverpool, are said to have taken out a patent for molding chicory in the shape of the coffee berry. English law at that time put no restriction on the sale of chicory. The use of chicory is supported by the fact that many persons prefer a mixture of coffee and chicory to pure coffee. The writer has personal knowledge of two cases where ladies, having drank coffee that greatly pleased them in first-class restaurants, and having asked how such coffee could be procured, were supplied with recipes in which certain grades of coffee and a certain preparation of chicory are directed to be used. In fact, such mixtures are supplied to order by the best grocers of our large cities. It is asserted that chicory is universally an ingredient of the finely flavored coffee that one finds in the *cafés* of Paris, Vienna and other European capitals; and there are gentlemen in New England, who, having cultivated chicory and used it in their coffee, freely express their preference for the mixture. In these cases, however, the chicory is kept duly subordinate to coffee, and good coffee at that, while in the "package coffee" peas, rye and chicory have largely the upper hand, and the coffee is small in quantity and that little of the poorest.

The demand for chicory has become so great, that it is not only a staple product of agriculture in most European countries, and cultivated to some extent in this, but has become itself to be the subject of extensive falsification with all the adulterants which are employed in the cheapening of coffee. Mr. Gay, who, once a manufacturer of mustard, coffee, etc., on his own account, was afterwards put in charge of her Britannic Majesty's Commissary Department, made the following statement before the Parliamentary Commission on Adulteration, in 1855: "I remember one year, when chicory was worth $105 per ton, manufacturing 700 tons of carrots into chicory. They were grown by one gentleman in Surrey, and supplied to the house where I was, and also 350 tons of parsnips."

But space is lacking to make further recital of the dreary history. Enough has been written to exhibit pretty fairly what human ingenuity and inhuman selfishness and recklessness have accomplished in the sophistication of human food.

(*To be Continued Next Month.*)

Paper Pulp from Wood.

The following is a description of the process of making wood pulp: The wood, four feet in length, and of any thickness, is brought in at the basement of the manufactory, placed in the barking-jack (one stick at a time), where two men with draw-knives rapidly peel off the bark. It is then conveyed by an elevator to the first floor, sawed in two-foot lengths with cross-cut saws, and passed on to the rip saw, where it is slabbed (that is, a small portion of wood on opposite sides taken off), to permit it resting firmly in the grinding engine. It is then passed to the boring machine (and upright 1½-inch auger, with foot attachment, driven by power), where the knots are bored out. The wood is then placed in racks of the same size as the receptacle in the grinding engine, and carried out to be ground. The grinding engines are upright, and receive at a filling one-20th of a cord of wood. The wood is placed in a receptacle, and by a simple, variable, automatic feed process, is pressed flatwise between two outward revolving rolls, composed of solid emery, which are flooded with a spray of water, carrying off the fibrilized pulp in a stream through revolving screens to the tank or stuff-chest in the basement. It is then pumped up into a vat that forms part of the wet machine. In this vat is constantly revolving a large cylinder faced with fine brass wire-cloth, which picks up the particles of pulp out of the water and places them on the felt (an endless piece of woolen goods which makes between rolls, for different purposes, a continual circuit of the wet machine). On the cylinder is turned a heavy roll, called the "couch"; between the two, where they meet, the cylinder leaves the pulp, with most of the water pressed from it. The pulp now makes its appearance on the felt above the concha roll in a beautiful sheet, 38 inches in width, and is carried along in a steady flow a distance of about 8 feet, where it passes between (the water here again being pressed from it) but not beyond two heavy rollers, the upper one iron, the lower one wood; it adheres to the upper roll, which is constantly turning, wrapping it up, and when a sufficient thickness is attained, is cut off by a knife being pressed to the roll, which is attached to the machine for that purpose. It now leaves the roll in a thick white sheet, 36 × 38 inches, which is received by a boy in attendance on a table conveniently attached to the machine, and folded into a sheet 14 × 26 inches. It is then placed on scales until the weight is 100 pounds, when it is placed in a press, and firmly tied into square, compact bundles. It is now ready for shipment to the paper mill.

Diamond Ink for Writing on Glass.

A mixture for writing on glass has lately been put on the market, under the name of "diamond ink," which is pronounced to be a very useful article for druggists and others for labelling bottles containing substances which would destroy ordinary labels. It has been examined, and found to consist of a mixture of ammonium fluoride, barium sulphate and sulphuric acid; the proportions for its manufacture being, barium sulphate, 3 parts; ammonium fluoride, 1 part; and sulphuric acid enough to decompose the fluoride and make a mixture of semi-fluid consistency. This mixture, when brought in contact with a glass surface with a common pen, at once etches a rough surface on the parts it comes in contact with. The philosophy of the action is the decomposition of the ammonium fluoride by the acid, which disengages hydrofluoric acid, which attacks the glass; the barium sulphate is inert and is simply used to prevent the spreading of the markings. The mixture must be kept in bottles coated on the inside with paraffine or wax.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2777) Gasolene.—I take great interest in reading your answers to correspondents, and would like some information respecting gasolene. How is it made? What are its chemical compounds? Will it freeze? At what temperature does it boil? What is the proportion of air in the gas made from it, as made by carburetting apparatus? By answering the above you will greatly oblige.—H. C. S., Camden, N. J.

(2778) Number of Elementary Substances.—How many really elementary substances are there? Some class fire among these; but as that is the result of combustion, I cannot see on what grounds it can be called a truly elementary substance. An early answer will oblige.—C. H. C., Williamsburgh, N. Y.

(2779) Mother Shipton's Prophecies.—There have been many allusions in the newspapers to the prophecies of Mother Shipton, who is said to have predicted the use of steam, the discovery of the electric telegraph, and other important events. If it is not too much out of the line of your journal, I would like you to inform me where these so-called prophecies are published, and whether they are authentic or fraudulent.—M. M., Hagerstown, Md.

(2780) Heating Power of Coals.—Can you give me a simple method by which I can determine, approximately—that is, near enough for practical purposes—the heating power of coals? I have neither the facilities of a laboratory, nor sufficient knowledge of the science, nor the time to use a chemical method of analysis. What I want, is what I may call a "rough and ready" method that will give a fair idea of the relative values of various coals. I will thank you for a reply through your useful journal.—T. J. Van H., Wheeling, W. Va.

(2781) The Canal Across the American Isthmus.—How long has the question of a canal across the American Isthmus been agitated? Did it originate in this country? By answering the above questions you will oblige an old subscriber.—T. J. D., Fort Wayne, Ind.

(2782) "Victoria" Stone.—Can you inform me how the so-called "Victoria" stone is made? It is an artificial stone, made, I am told, according to a patented process, and is reported to be very successful. Do you know, also, if the inventor has an agent or represenitive in this country?—F. A. G., Williamsburgh, N. Y.

(2783) Formula for Evaporation.—I notice on page 47 of your February number a formula, but I cannot understand clearly the application of it. For instance, I do not see why E 212° is presented for use in formula, and do not understand how to use it. And then I do not see how you are to use the numbers whether thus: 1114+(0.305 Ts)−Tw, or thus, (1114+0.305) Ts−Tw. There is a great difference. Could you favor me with an example, and work it out?—J. H. C., Germantown, Philadelphia.

(2784) To Transfer Negatives to Wood.—How is the transfer of photo-negatives to wooden blocks accomplished?—J. B. Q., Philadelphia.

(2785) Manifold Paper.—I will be obliged if you will publish a recipe for preparing paper for taking manifold copies.—L. B. M., Montgomery, Ala.

(2786) Longsightedness.—Is there any explanation for the longsightedness so common among old people?—R. V., Minneapolis, Minn.

REPLIES.

(2777) Gasolene.—Gasolene is the name given to a commercial product obtained from crude petroleum by fractional distillation. It is not a simple chemical compound, but is probably a mixture of many, or at least of several. Petroleum, from which gasolene is obtained, is composed essentially of hydrogen and carbon, and it is therefore customary to designate all the products obtained from it as hydro-carbons. It is not a simple substance, but a highly complex one, consisting of a mixture of a number of hydro-carbons, of which marsh gas is the type. In the commercial process of refining the crude oil, the products obtained are only roughly separated by the fractional distillation to which it is subjected, and consequently gasolene (which is one of them) is not a simple substance, but merely a name given to a mixture of oils that passes over from the still at a certain stage of the refining process. This will be better understood from the following explanation: The apparatus for fractional distillation consists of an iron still, provided with a coil or worm of wrought-iron pipe, which is submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil as it comes from the wells, the fire is started beneath it, and the oil soon begins to boil. The first products of distillation are gases, which at ordinary temperature pass through the coils and escape without being condensed. By cooling with ice, or by compressing these gases by an air pump into a strong receiver, they are condensed into liquid form, giving the lightest products of petroleum, known as rhigolene and chymogene. Soon the vapors begin to condense in the worm, and a stream of oil trickles into the receiving tank. The first oils obtained are very light, and as the distillation proceeds they become heavier and heavier. It is customary to separate the distillates, according to their gravity—as determined by the hydrometer—into the several commercial products designated in the following table:

PRODUCTS OF THE DISTILLATION OF CRUDE PETROLEUM.

Gravity. Beaumé.	Name.	Percentage yielded.	Average Gravity. Beaumé.	Remarks.
115° to 105°	Chymogene........	....	110°	Condensed by pump; boils at 32° F.
105° to 95°	Rhigolene	....	100°	Condensed by ice and salt; boils at 65° F.
95° to 80°	Gasolene	1½	85° to 90°	Condensed in worm by cold water. Used in air-gas machines and carburetters. Boils at from 100° to 160° F.
80° to 65°	Naphtha............	10	71° to 76°	Used in the arts as a solvent for cleaning, and for adulterating kerosene.
65° to 60°	Benzene	4	62° to 65°	For paints, varnishes, etc.
60° to 38°	Kerosene or refined Petroleum.... ...	55	46°	Oil suitable for lamps.
38° to 25°	Paraffin Oil..........	19½	30°	Semi-solid when cold. Chilled and pressed to separate paraffin. Oil used for lubricating.
	Coke, Gas and Loss..	10		
	Total...............	100		

The above table gives a clear outline of the various products obtained by fractional distillation. The plan in vogue is to run the product into one tank until the gravity reaches 65° or 59° B. This product, known as crude naphtha, is then subsequently separated into (1) gasolene, the lightest; (2) naphtha, and (3) benzene. When the stream of oil runs from the coil with a gravity of from 65° to 59° B., it is diverted into the kerosene tank, and continues to run into this receiver until the gravity reaches about 38° B., or until the color deepens to a yellow. This second portion is the kerosene, or burning oil, and is subsequently purified by sulphuric acid and alkali. The stream is next diverted into the paraffin oil tank, where it is allowed to run until nothing remains in the still but coke. The paraffin oil is then chilled to crystallize the paraffin, and is then folded in cloth and subjected to hydraulic pressure to squeeze out the oil, while the paraffin, remaining behind, is purified by repeatedly dissolving in naphtha, chilling and pressing. The oil is purified in the same manner as kerosene. Gasolene not being a simple compound, but a product distilling over with a gravity between 95° and 80° B., has no fixed boiling point, and this varies according to circumstances, as the product happens to be lighter or heavier, between 100° and 176° Fah., the average boiling point being about 138° Fah. Gasolene cannot be frozen by any degree of cold. The proportion of air in the gas made from it by carburetting apparatus is not constant, but will vary according to the temperature, quality of the gasolene, and speed of the air current. The gasolene will volatilize more rapidly in warm than in cold weather, so that the air will be more completely saturated in warm weather than in cold; again, the process of volatilization chills the oil and diminishes the quantity evaporated; and the gasolene not being a simple substance, but a mixture of liquids, the lighter products will pass off first, leaving the heavier and less volatile portion behind. And the amount of vapor taken up will depend upon the speed with which the air passes through the carburetter, so that when the number of burners is varied the quality of the gas changes. There is probably always an excess of gasolene vapor in the gas made by carburetting machines; probably an average would be two or three volumes of gasolene vapor to one of air; but these portions will vary considerably, for the reasons stated above.

(2778) Number of Elementary Substances.—The ancients held the notion that the elementary substances were "fire, air, earth and water," and that everything in the visible world was composed of various mixtures, or combinations, of these elements. It was only as the science of chemistry was gradually developed that the crudity of this and similar notions came to be recognized. The modern idea of an element, is that of a substance which cannot be further decomposed, or resolved. It is apparent, therefore, that we have no *positive* proof of the simple character of the substances now recognized as elements. For although they may defy the most powerful agents of decomposition that the chemist of to-day is able to bring to bear upon them, it is by no means certain that far more powerful agencies may not be discovered in the future, with the aid of which the chemist of the future may resolve our present elementary substances into a few primal substances of which they (our so-called elements) are combinations. All that we may say with safety is that there are some 67 bodies which the chemist has thus far been unable to further resolve, and these he assumes to be elementary. They are generally divided into two classes—the metals and the non-metals. We append a list of them herewith, arranged in alphabetical order, in which the non-metals are distinguished by *italics*, and such as are found abundantly in nature are indicated by a (*):

LIST OF ELEMENTARY SUBSTANCES.

*Aluminum.	Nickel.
*Antimony.	Niobium.
Arsenic.	*_Nitrogen._
Barium.	Osmium.
Beryllium.	*_Oxygen._
*Bismuth.	Palladium.
*_Boron._	Phillipium.
Bromine.	Phosphorus.
Cadmium.	Platinum.
Caesium.	*Potassium.
*Calcium.	Rhodium.
*_Carbon._	Rubidium.
Cerium.	Ruthenium.
*_Chlorine._	_Selenium._
*_Chromium._	*_Silicium._
Cobalt.	*Silver.
*Copper.	*Sodium.
Didymium.	*Strontium.
Erbium.	*Sulphur.
*_Fluorine._	Tantalium.
Gallium.	_Tellurium._
*Gold.	Terbium.
*_Hydrogen._	Thallium.
Indium.	Thorium.
*_Iodine._	*Tin.
Iridium.	Titanium.
*Iron.	Uranium.
Lanthanum.	Vanadium.
*Lead.	Wolfram.
Lithium.	Ytterbium.
*Magnesium.	Yttrium.
*Manganese.	*Zinc.
*Mercury.	Zirconium.
Molybdenum.	

As our correspondent rightly observes, "fire" is merely a phenomenon which accompanies energetic combustion.

(2779) Mother Shipton's Prophecies.—The so-called prophecies of Mother Shipton, which in the form of some twenty lines of doggerel verse, have lately been widely circulated, have been clearly proved to be forgeries. The interest attaching to them just now, may probably be explained by the fact that they predict the end of the world in the present year of 1881. The true history of Mother Shipton is briefly as follows: She is said to have been a nun in a convent in the North of England; her alleged birth-date being 1488, and the year of her death 1561. Among the many literary curiosities of the British Museum, there are some volumes printed about the years 1641 and 1642, treating of the prophecies of Mother Shipton, foretelling the death of Cardinal Woolsey and others, and also what should happen in ensuing times. Doubtless some of her guesses were lucky enough to be verified, and the tradition of her prophetic gift, with the usual extravagant adornments added from time to time, has survived to our day. So late as 1797, "Mother Shipton's Curious Life and Prophecies" was published in a 4to volume in the North of England. This work, and its more ancient predecessor, contains no trace of the prophecies that are now popularly attributed to Mother Shipton. In the form in which the "prophecies" are now contained, they appeared in an English periodical known as *Notes and Queries*, in which publication for December 7, 1872, a certain Simeon Rayner published what he called an "Ancient Prediction (entitled by popular tradition 'Mother Shipton's Prophecy'); published in 1448, republished in 1641." These lines are what are now popularly known as Mother Shipton's Prophecies. They run as follows:

"Carriages without horses shall go,
And accidents fill the world with woe;
Around the earth thoughts shall fly
In the twinkling of an eye;
This world upside down shall be,
And gold be found at the root of a tree;
Through hills man shall ride,
And no horse be at his side;
Under water man shall walk,
Shall ride, shall sleep, shall talk;
In the air man shall be seen,
In black, in white, in green;
Iron in the water shall float
As easily as a wooden boat;
Gold shall be found and shown
In a land that's not now known;
Fire and water shall wonders do;
England at last shall admit a foe;
The world to an end shall come
In eighteen hundred and eighty-one."

This ingenious scrap of doggeral appears to foretell the discovery of the uses of steam, its application to rapid locomotion, the discovery of the electric telegraph, the tunneling of mountains, submarine apparatus, the construction of iron ships, the

discovery of gold in California or Australia, and other notable events; while it distinctly refers to the solution of the problem of aerial navigation. Of special interest, of course, are the last two lines, wherein the end of the world is fixed for the present year. The statement of Simeon Rayner accompanying the publication of these verses in *Notes and Queries*, is shown to be false on its face. The first book printed in England was in the year 1471, while Rayner states these prophecies were published some twenty-three years earlier (in 1448). To make an end to the subject, we may add that the same periodical—*Notes and Queries*—in its issue of April 26, 1873, contained the statement, in its answers to correspondents, that Charles Hindley, of Brighton, had "made a clean breast of having fabricated the above, about twenty lines, with some ten others, in his reprint of a cheap book version, published in 1862." This effectually disposes of the question of the origin of the so-called prophecies of Mother Shipton.

(2780) Heating Power of Coals.—The following method, we think, will answer this correspondent's purpose, as it is readily performed, and the results, if the work is carefully done, will give a close approximation to strict accuracy. The process of determining the heating power of coals, given below, is that proposed by an English chemist, Thompson, and is known as "Thompson's method," and the result is expressed in terms of pounds of water a unit of weight of coal will convert into steam. The method requires an apparatus of the following construction: A cylindrical vessel of copper, open below and punctured around the bottom with several rows of small holes. Dimensions, say 8 inches high and 1½ or 2 inches in diameter. The top of the cylinder is provided with a cover of the same metal, and to the center of the cap is attached a slender tube of copper about 10 inches long, provided at the upper extremity with a stop-cock. A small base piece with a flared rim is provided, which will fit snugly into the bottom of the cylinder, best furnished with a couple of springs to insure that it will stay in place when lifted about. The base piece should have a small collar in the middle, into which a small cylindrical copper receiver may be placed securely in an upright position. This receiver is intended to hold the charge of coal as below described, and should be about 2 or 2½ inches high by ¾ of an inch diam. The operation is as follows: Take an accurately weighed portion of the coal to be tested, which has previously been pulverized very finely in a mortar; mix it intimately with about twice its weight of a mixture of nitrate and chlorate of potassa. Place this mixture in the small copper cup or receiver, set the latter in the collar of the base piece, and insert one end of a fuse (a string saturated with saltpeter and dried) into the mixture with a knife; adjust the fuse, shove the cylinder (the stop-cock above closed) down upon the base piece, lift the whole apparatus carefully, and quickly lower it into a tall cylindrical glass jar containing a known volume of water, whose temperature has previously been taken and noted. The stop-cock in the tube of the apparatus being closed, the access of water to the interior of the cylinder is prevented. Combustion soon sets in, and continues energetically until the combustible is completely consumed, the niter and the chlorate furnishing the oxygen needful for the combustion. As soon as combustion has ceased, the stop-cock above is turned, and the water is permitted to enter the air chamber to cool down its heated interior. This is facilitated by gently raising and lowering the apparatus by the stem. In a few minutes the temperature will be equalized, and the operation is concluded by carefully noting the temperature of the water again. We have now all the data necessary to determine the heating value of the tested sample. The relative weights of the coal to be tested and the water used, should be as 1 to 1,191. For, since to convert 1 pound of water into steam (from 0° to 212°) requires 1,191 heat units to be imparted to it, every degree of temperature the water is raised by the combustion of the coal, which imparts its heat to the water, represents, if these proportions have been observed, 1 pound of water converted into steam. For convenience sake, we may add that a gallon of water is almost exactly 1,191 times 50 grains. The most convenient proportions to take, therefore, will be 50 grains of coal and 1 gallon of water, or 100 grains and 2 gallons. If the thermometer at the close of the experiment should register 10° higher than at the commencement, 1 pound of the coal tested will convert 10 pounds of water into steam; if the thermometer indicates 12° rise, then the coal will convert 12 pounds into steam, and so on. It is well to observe the precaution in this method of having the body of water considerable and the jar tall, so that the combustion products will become thoroughly cooled off by the time they reach the surface. Any multiple of the proportion of water before suggested, can be used to this end and accounted for in the calculation. To make the process still more accurate, it is advisable to determine the percentage of error (by loss of heat from imperfect absorption in the water, conduction, etc.) by making a series of experimental trials with a coal whose heating power has been accurately determined by chemical methods. By averaging the results obtained in this way, and comparing the average with the standard value obtained by chemical methods, the percentage of error in the Thompson method may be obtained and added as a constant factor to the results.

(2781) The Canal Across the American Isthmus.—The subject of the construction of a canal across the American Isthmus did not originate in this country (that is, with Americans, as we understand the question), but, on the contrary, is almost as old as the discovery of the American continent. The aim of Columbus in setting out on his voyage of discovery was to discover and open a route from Europe westward to China, Japan and India; and he died in the belief that the country he had discovered was a portion of the dominions of "the Great Kahn," the Emperor of China. The subsequent discoveries of the Spaniards along the shores of North and South America and the Isthmus, and especially the magnificent discovery of the Pacific Ocean by Balboa, dispelled this error, and gave a tolerably correct idea of the proper geographical position of the American continent. From that time forward it was the constant effort and aim of explorers to find some passage through the line of the American continent which would give to the successful discoverer the key to the treasures of the Indies. In this quest for the "secret of the Strait," as it was then romantically termed, all the maritime nations of Europe participated. Charles Sumner, in the Senate of the United States, speaking on this subject in 1867, made the following references to the historical interest of the problem: "The problem of interoceanic communication has not only a practical value, but a historical grandeur. From the time of Charles V., one of the aspirations of Spain, and of all adventurers and navigators in these seas for many years, has been to find what was called a gate by which to pass through the Isthmus into the other ocean." With the national decay of Spain, and the encroachment of more enterprising rivals upon her possessions in the New World, the Spanish government adopted the policy of repression, and fearing lest a knowledge of the mineral riches of the country, and the possibility of making an artificial passage across the Isthmus, might tempt her rivals to wrest the country from her control, rigorously excluded foreigners of any nation from penetrating into the country. Thus it came about, from the jealousy of Spain and the imperfect knowledge of the geography and topography of the Isthmus, that no serious movement was made until the year 1814 to establish interoceanic communication. The French author, M. V. A Malte Brun, in his "Annales des Voyages," referring to the surprising indifference of Spain upon this important subject, writes that "the Court of Madrid, far from encouraging projects for easier and more rapid communication, forbid, on pain of death, the use of the plans proposed. They wronged their own colonies by even falsifying their charts and representing the coasts as dangerous and the rivers impassible. In the year 1814, as above named, the Cortez finally authorized and decreed the construction of a canal across Tehuantepec; but the decree came too late, as the revolt of the Spanish American colonies followed shortly thereafter. Since that time the importance of the problem of interoceanic communication has been the theme of much discussion both in Europe and the United States. It has been made the subject of numerous State papers and treaties between interested nations, and scores of exploring expeditions have searched the Isthmus high and low to find the most desirable route of passage. In this last work, American engineers have done more than those of any other nation, as the work of Selfridge, Lull, Childs, Trautwine and others testifies. Nevertheless, in spite of the special reasons why the government of the United States should have taken the work of constructing a canal into its own hands long ago, in the interests of their commerce, it has been left, as we all know, to the energy and enterprise of Lesseps to actually undertake the performance of this historical task.

(2782) "Victoria" Stone.—The so-called "Victoria" stone is made after a process patented by Mr. Frederick Ransome, an English inventor, who has acquired an extensive reputation for the improvements which he has introduced into this branch of manufacture. Several of Mr. Ransome's processes, we believe, are patented in this country, the patent for the particular process referred to in F. A. G.'s inquiry being dated about 1872 or 1873, as he may readily ascertain by consulting the Patent Office reports about that time. The Victoria stone is made as follows: Blocks of concrete of the desired form and size are molded from a mixture of hydraulic cement (generally Portland of good quality) and an infusorial earth rich in silica; and when dry they are immersed in a solution of silicate of soda. Under these circumstances, these masses, which contain a considerable percentage of uncombined lime, are rapidly hardened by the formation of silicate of lime, the silica being furnished by the silicate of soda. The alkali set free in the process at once seizes upon a fresh portion of free silica contained in the infusorial earth which forms a portion of the original mixture, converting this into soluble form as silicate of soda, in which form it is made available in converting a fresh portion of the free lime in the cement into the form of insoluble silicate of lime. In this manner the limited quantity of soda contained in the mixture acts as the carrier of a large quantity of silica to the lime, thus materially hastening the process of solidification. As this operation progresses, a portion of the soda is continuously bound up in the compounds formed, and ultimately all of the alkali is thus combined, and the tendency to efflorescence, which was one of the objectionable qualities of the earlier artificial stones made by Ransome, is largely or entirely obviated. If we may rely, however, upon recent reports, a later process of Mr. Ransome has proved so successful as to entirely throw into the shade his former successes. His latest process for making an artificial stone involves the utilization of blast furnace slag. He burns a mixture of lime and finely pulverized slag, and obtains a cement therefrom which is spoken of in terms of the highest praise. It has been proven to set much more rapidly than Portland cement, and to attain greater ultimate hardness and tensile strength; at the same time it has the advantage of possessing a much lighter and more agreeable color, and of being manufactured at much less cost. This process will be found described in the Manufacturer and Builder for 1880, page 120, among other methods of utilizing the slag of blast furnaces.

(2783) Formula for Evaporation.—The formula in question referred to by this correspondent, is embodied in the "Preliminary Report of the Committee of the Franklin Institute Appointed to Examine into the Modes of Determining the Horse-Power of Steam Boilers," which was published in the *Journal* of the Institute for August, 1871, the formula appearing on page 95 of that issue. By somewhat of a coincidence the name of this correspondent is attached to this report as a member of the committee and a signer, as is also that of the editor of the Manufacturer and Builder. In giving the formula in reply to J. N. B., of Springfield, Ill., in our last issue, we simply transferred it literally as it appeared in the committee's report, without deeming it necessary to verify it. J. H. C.'s inquiry, however, induced us to refer to the formula again, and on examining it critically, the discovery was made that the formula, as published in the committee's report, is wrong. By an oversight, probably, the value of E has been put in place of E 212°. By making the change, J. H. C. will find that the formula will work all right. It should be stated thus:

Let E 212° = number of feet or pounds evaporated at 212° in a given time.

E = number of feet or pounds evaporated under the conditions taken.

Tw = temperature of water fed into boiler.

Ts = temperature of steam formed in boiler.

$$\text{Then } E\ 212^\circ = E\left\{\frac{1114 + 0.305\ Ts - Tw}{966}\right\}$$

The values in brackets should be worked out thus: 1114 + (0.305 Ts) − Tw; *not* (1114 + 0.305) Ts − Tw. Take the following example:

Let E = 100 pounds of water evaporated.

Tw = 80° and Ts = 285°. Then

$$E\ 212^\circ = 100\left\{\frac{1114 + (0.305 \times 285) - 80}{966}\right\} = 116\text{; that is, the}$$

equivalent evaporation at 212° is 116 pounds of water. By using the same values as above, and working out the result by the formula as published by the committee (the same as that given in our last issue), the answer will be found to be 86.12 pounds. This is obviously wrong, for it makes the quantity of the evaporation at a higher temperature and pressure greater than at the lower temperature and pressure, when it is manifest that the same number of heat units expended will evaporate more water at 212°. In the same report, J. H. C. will find a simple proportion given for the same purpose. It gives substantially the same results as those obtained in the formula as corrected. It is as follows: As 966 : (1178−T) :: water evaporated : water evaporated at 212°.

(2784) To Transfer Negatives to Wood.—The operation of transferring photographic negatives upon wood blocks for engraving, is something of a trade secret. Nearly every one operating in this direction has some special method, or thinks he has, that is better than any other. The truth most probably is, that the operation is an extremely simple one, merely requiring a little experience, and the difference between the operations are most probably in minor and unimportant details. The following method our inquirer will find to work well with a little practice, and is simple: Size the wood block first with a mixture of albumen and whiting (or other inert white powder), to which a little salt has been added, care being taken to observe that the film shall be very thin. Then proceed substantially as in paper printing, namely, sensitize with nitrate of silver, fume with ammonia, print from the negative, and fix with hyposulphite of soda.

(2785) Manifold Paper.—Manifold copies are taken on fine tissue paper, like that of an ordinary letter-book, by interposing between each leaf or sheet, a sheet of heavier paper prepared with some dark coloring matter which is caused to offset by the pressure of a blunt pencil. The number of copies that can be made in this way is about half a dozen at a time. The offset paper is prepared from sheets of ordinary soft paper, by smearing them with a composition made of grease and plumbago or lampblack. This mixture is allowed to remain on for twelve hours, and the paper then wiped smooth with a piece of wool or cotton waste. In copying, a sheet of common writing paper is laid over the uppermost black sheet, and the writing is done with a blunt pencil. The "hektograph" is so great an improvement, however, over this and other methods of making copies of writing, that it has practically superseded them.

(2786) Longsightedness.—The explanation of longsightedness (or farsightedness) which commonly occurs in old people, is a very simple one. The eye becomes flattened by a diminution of its fluids, or some structural change takes place in the crystalline lens by which its convergent power is diminished. The images of objects near the eye, therefore, are indistinct, because the rays of light proceeding from them are slightly divergent, and the converging power of the crystalline lens is inadequate to focus them upon the retina, but tend to focus the rays behind it. This defect is remedied by the use of convex glasses, which make up for the weakened convergent power of the eyes. With such aids, the rays from objects near at hand are rendered parallel or slightly convergent before entering the eye, thus enabling a distinct image to be formed upon the retina.

THE MANUFACTURER AND BUILDER,

Vol. XIII.—No. 4. APRIL, 1881. THIRTEENTH YEAR.

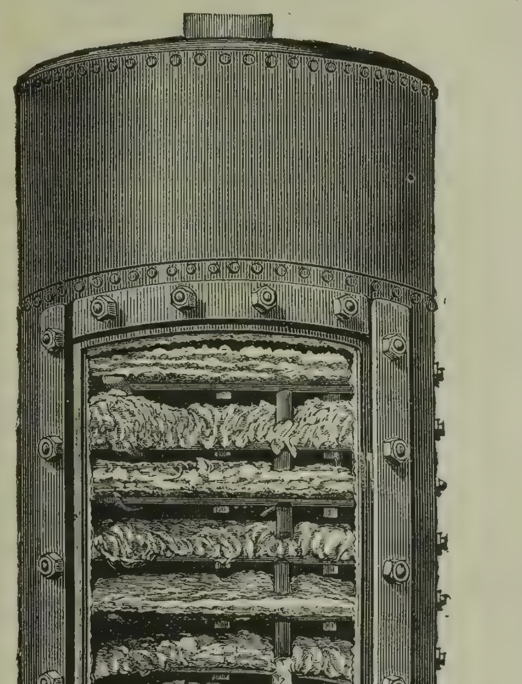
Stilwell's Lime-Extracting Heater and Filter.

The accompanying engraving illustrates the construction and effectiveness of the apparatus known by the above name, and which has so completely demonstrated its utility as to have secured a deserved reputation from steam users throughout the country. It is hardly necessary for us to point out to steam users the facts relating to the dangers arising from the formation of scale in steam boilers, since this would simply be rehearsing statements that have again and again appeared in the MANUFACTURER AND BUILDER under various forms. We shall, therefore, simply content ourselves at this time by presenting the conclusions reached by scientific men respecting the enormous losses in the effective heating power of fuel which may be directly traced to the presence of scale in steam boilers, and which speak loudly in favor of some efficient remedy.

The subject of scale in steam boilers, and the incidental losses and dangers which it occasions, has been studied and formulated by several authors of eminence, but none have presented the magnitude of the evils resulting therefrom more concisely and instructively than Dr. Joseph G. Rogers, the results of whose labors in this direction were first presented to the American Association for the Advancement of Science at their meeting in Indianapolis, Ind., in 1870, in a paper which has since come to be looked upon as authoritative on this highly practical subject. Dr. Rogers' views of the nature and the effects of scale in steam boilers are as follows:

"The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power, as compared to that of iron, is as 1 to 37.5. This known, it is readily appreciated that more fuel is required to heat water through scale and iron than through iron alone. It has been demonstrated that a scale one-16th of an inch thick requires the extra expenditure of 15 per cent more fuel. As the scale thickens the ratio increases; thus, when it is $\frac{1}{4}$ of an inch thick, 60 per cent more is required; at $\frac{1}{2}$ inch, 150 per cent, and so on. To raise steam to a working pressure of 90 pounds, the water must be heated to 320° Fah. This may be done through a $\frac{1}{4}$-inch iron shell by heating the external surface to about 325°. If a $\frac{1}{2}$-inch scale intervenes, the boiler must be heated to 700°—almost a low red heat. The higher the temperature at which iron is kept, the more rapidly it oxidizes, and at any temperature above 600° it soon becomes granular and brittle from carbonization, or conversion into the state of cast iron. Weakness of boilers thus produced, predisposes to sudden explosions, and makes expensive repairs necessary."

These statements are sufficiently forcible and authoritative to convince the most indifferent of steam users that the deposit of scale in his boiler is not merely troublesome, but a positive evil, contributing probably more than any other factor to wastefulness in the use of fuel, and to the disposition to explosion. After such a presentation of the facts of the case, no further argument will be required to prove the necessity of providing means of counteracting the evil. There are three possible methods of overcoming this difficulty. They are: 1st. Picking the scale off by mechanical means. This is slow, clumsy and applicable to certain builds of boilers only. 2d. Purging the boiler by means of the chemical compounds known as boiler powders. This is dangerous, chiefly from the evident fact that an acid or other chemical strong enough to eat off the scale will not stop there, but will go ahead and eat the boiler shell as well. 3d. The use of pure water. The simplest and surest way is always the safest and best. If the water is purified from scale-forming material before entering the boiler, certainly no scale can form.



Lime-Extracting Heater and Filter.

With this introduction, we may proceed to the description of the apparatus here shown. It consists of an iron vessel of suitable size, constructed in various shapes, but usually of upright cylindrical form, into which the escape steam from the engine is exhausted. (Where no engine is employed, it may be arranged for using steam direct from the boiler). The cold water intended for the boiler enters the heater at its top, and in its passage downward to its outlet is thoroughly boiled, which process liberates the free carbonic acid, sets free the salts held in solution, and precipitates them upon suitable removable surfaces provided for their reception.

A large percentage of the mineral impurities contained in the surface waters used for boiler-feeding, consist of the carbonates of lime and magnesia, and it is well known that these (and other carbonates) are held in solution by the presence of carbonic acid gas absorbed by the water. The disengagement of the carbonic acid gas which follows upon the application of considerable heat, is followed by the immediate precipitation of the mineral substances which it had held in solution. This is substantially what the Stilwell heater effects. Its action is about as follows: The water enters at the top of the heater, and in its downward passage traverses a large area of heating and depositing surfaces, arranged in the form of removable shelves, having alternate openings. As the thin sheet of water passes over these shelves, all of which are very hot, and descends from shelf to shelf, it is met in its downward course and constantly acted upon by an ascending current of steam which enters the heater at the lower port. The action of this lower current of steam completes the separation and precipitation of the foreign particles which is begun when the water enters the heater. The construction of the heater is such that not a drop of water can pass down through it without being thoroughly boiled. The mineral impurities which this process of boiling sets free from the water, are deposited upon the entire series of shelves, the deposit always being heaviest upon the upper shelf and diminishing in quantity as it approaches the lower shelf. From this lower shelf the water passes through the filtering chamber, which completes the purification, and it is then fit to enter the boiler.

The makers claim for this apparatus the following special merits: The escape steam from the engine is utilized, and the volume used enables the purifying of large quantities of water, while every particle of the water is boiled thoroughly. No other heater applies the same degree of steam heat, nor does any other allow the same opportunity for salts to deposit. The arrangement of the shelves and the ease with which they can be handled and withdrawn for cleansing. The filtering system, the leading point in which is that the water passes upward through the filtering chamber on its way to the discharge pipe, and not downwards or sideways, as is usually the case. The arrangement by which the door of the heater is fastened; no bolts, set-screws or keys are used, and the door of the largest heater can be removed in a couple of minutes. The heater is self-contained, occupies but little space, is very simple; easily and cheaply attached, and cannot get out of repair; finished in workmanship; supplied with a glass water gauge, waste cock, and can be successfully operated by a common laborer. The peculiar adaptness of the upright round heater for muddy water, and water impregnated with iron, sulphur, etc. It is claimed that the use of the Stilwell heater effects a saving of at least 10 per cent of fuel where soft water is used, and when "hard" and impure water is used it will effect a saving of from 15 to 50 per cent of fuel, not to mention the saving to the boilers, in time, and in obviating the necessity occasioned by "scale" of frequently "blowing off" and cleaning.

Applying the conclusions reached by Dr. Rogers to practice, we may say for the consideration of steam users, that under ordinary circumstances a new boiler will accumulate, after about four months' use, one-16th

of an inch of scale; after eight months, $\frac{1}{2}$ of an inch, and so on. The inference appears, therefore, to be justified that after one month's use a boiler ordinarily consumes $3\frac{1}{2}$ per cent more fuel than at first; after two months, $7\frac{1}{2}$ per cent more fuel, or say as an average for the year, about 20 to 25 per cent more fuel than would be required for the same service in steam-making had pure water been used.

The subject, therefore, of preventing the formation of scale in boilers is one that directly touches the pocket of the steam user, and the consideration of the best methods of its prevention is worthy of his special attention. We consider the principle upon which the above described apparatus is based, to be the simplest that could be devised; and its utility in actual service has been abundantly demonstrated during the past ten years. At present there are over 3,000 of the Stilwell heaters in daily use throughout the country, upon all kinds of water.

Our engraving gives a clear idea of the construction and action of this heater. It is described as having been made from a photograph of one of the No. 5 upright round heaters now in use in Dayton, Ohio. The door of the heater is removed for the purpose of exhibiting the shelves, loaded with deposits of carbonate of lime, accumulated in a run of two weeks. It is not a fancy sketch, but a *fac simile* of the said heater when the door was removed. The manner in which the lime deposits upon the shelves is so clearly portrayed by the artist as to render further comment unnecessary, and demonstrates beyond question the efficiency and utility of the heater.

More specific information may be had on application to the makers, the Stilwell & Bierce Manufacturing Company, Dayton, Ohio.

The Manufacturer and Builder.

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Extra Edition of May Number.

We desire to announce an issue of 10,000 extra copies of the May number of the Manufacturer and Builder for gratuitous distribution among the Manufacturing and Building interests of the country. The addresses to which this special number will be sent have been very carefully compiled and comprise all the prominent manufacturers, machinists and builders in the United States, not already reached by our regular circulation. This large extra issue in addition to the latter will offer one of the most valuable opportunities that could be afforded advertisers for reaching the special lines of trade to which the number will be devoted. We trust that our efforts to serve the industrial community will be recognized by their liberal support, and we shall be pleased to furnish estimates for space or give any further information desired on application.

Underground Telegraphic System.

In view of the very general interest at present manifested in the subject of underground telegraphy, it may not be out of place for us at this time to supplement our several editorial articles in advocacy of this innovation, with some account of the methods in use abroad for laying and operating underground lines.

As remarked in these earlier articles, in nearly all the larger cities of Europe, neither poles nor wires are visible, but the system of underground cables is used instead. These cables usually contain from five to seven conductors each, insulated with gutta-percha, and the whole protected with an armor of iron wires. This plan has shown itself to be both economical and reliable in practice. There are now in Paris working lines that have been buried for twenty years, and which have been the cause of little or no expense, except their first cost. Respecting the immunity of the underground system from incidental dangers, Mr. Brooks, whose report on the telegraphic systems of Europe we have before referred to, makes the very significant remark that, in Paris, during the reign of the Commune, when almost every institution of public utility was destroyed, not a single underground wire was disturbed.

In giving the history of the underground telegraph in Paris, M. Bontemps states that experiments, with the view of supplanting the overhead wires in that city, were instituted as early as 1855 by the French Telegraphic Administration. At first, bare iron wires were stretched in a wooden trough, and covered with a bituminous compound. In 1858, this plan not having been found to possess the requisite permanency, the cables were encased in leaden tubes, the conductors having first been covered with gutta-percha, and this in turn with a ribbon of tarred cotton wound spirally around it. This system, it is reported, lasted but a short time, the effects of the coal gas in the soil causing the gutta-percha to lose its insulating qualities, while the lead tubing was found insufficient to protect the cable from accidental damage.

M. Baron's system—a modification of the one just described—has, however, come into general use in Paris and other large cities of France, and the statement is made that, as now constructed, no trouble whatever is experienced respecting the permanency of the underground system. M. Baron's plan may be understood from the following description: Each conductor is formed of four copper wires twisted spirally, and covered with gutta-percha to a diameter of one-fifth of an inch. Over this is placed a layer of tarred cotton, a tarred tape, and over all a covering which is not tarred. The outside layers are treated with a sulphate of copper solution before receiving the tar. Care is also taken to make use of vegetable tar only, as gas tar would attack the gutta-percha. In this manner, cables of three, four, five, six and seven wires are constructed, mostly however of seven wires, this number being found the most convenient for general service. Instead of leaden tubes, the cables are now encased in cast-iron pipes in lengths of about 8 feet, similar to those used in distributing gas and water. The joints are carefully closed by leaden rings. At every 164 feet the pipe is not jointed, but a larger pipe slides over both ends in the form of a coupling, and the sliding joint is carefully soldered. These are for the purpose of testing, when they may be unsoldered and removed, leaving the cable bare. When a wire is found to be faulty, the cable is cut at the coupling nearest the fault, and drawn out, a string being fastened at the further end, to which is afterwards fastened the new piece to be drawn in. If the joints are well made, the tube is air-tight and proof against infiltrations of every nature. Cables constructed in this manner will remain in perfect order for a very long time, while repairs are easily made and without much expense, if the position of the coupling is properly marked.

The sewers of Paris afford excellent facilities for the construction of underground lines. The cables which are placed in the sewers are encased altogether in lead tubing, the joints of which are made with the utmost care, to prevent the infiltration of gases, which might destroy the insulation of the gutta-percha. The cables are supported by iron hooks of horseshoe form, the shanks of which, four inches long, are imbedded in the masonry. These leaden tubes are one-13th of an inch in thickness, and are laid in sections of 328 feet. The total length of the undergound lines in Paris, in 1876, was 116 miles, of which $35\frac{1}{2}$ miles were laid in trenches, and $80\frac{3}{4}$ miles in the sewers. The cables are composed of one, three, five and seven wires, mostly the latter number, and the wires have an aggregate length of $2,266\frac{1}{2}$ miles.

In Switzerland, leaving out of consideration the numerous under-lake cables, the underground system is in very general use in the larger cities and towns, and across the dangerous passes of the Alps. These last in some cases are at a hight of 2,400 meters (7,900 feet) above sea level. There are such underground lines across St. Gothard, the Simplon and the Flüela. Each cable is composed of three or five wires of one-50th of an inch, twisted together. This wire is covered by a double gutta-percha sheath, and wound around the gutta-percha is a hemp covering saturated with Chatterton's compound (1 part Stockholm tar, 1 part resin, and 3 parts gutta-percha). The different cores of the cable are united in one single strand, which is enveloped in three layers of hemp soaked in Chatterton's compound, the first and last in the form of ribbons, and the one in the center in the shape of wires or strands. The whole is enclosed in a leaden tube, hermetically sealed. These cables are buried in the ground to a depth of from two to three feet. The cable is surrounded by sand, and covered with flat stones and the trench filled up with ordinary gravel. In all the railroad tunnels of any length, the overhead wires have been replaced by cables, either buried in the ground in the manner just described, or laid in wooden tubes or troughs fixed upon the walls of the tunnel. In the cities the cables are sunk into brick trenches, or in the sewers or in iron tubes.

In most of the Bavarian cities, and in Vienna, Brünn, Prague and other cities of Austria, the underground

system has been more or less completely in use for a number of years. In all the large cities of the Netherlands underground lines only are used as a means of telegraphic communication. The wires are insulated with gutta-percha, and encased in cast-iron tubes or bitumenized paper.

The list of Dutch cities using the underground system embraces no less than forty-seven names. In Sweden the system is in use in Stockholm, Gothenborg, Malmö, Norrköping, Gefle and other cities.

In England the underground system is in use in many of the larger cities, and we know of one case where a line of considerable length has been in use for a period of ten years without the slightest interruption. We refer here to the line between Manchester and Liverpool, a cable of 14 wires, laid down in 1871. This line is 36 miles long; 14 miles of it are laid in iron pipes, and 22 miles in pipes of stoneware.

It is, however, in Germany that the greatest success in laying and operating underground lines has been attained. Not only is the system in operation in all the more important cities and towns of the German empire, but of late it has been successfully extended to connect cities, towns, fortresses, etc., with each other, and with the capital city, Berlin. In Cologne such lines have been in continuous and successful operation for the past thirty years. In 1876, the first experimental land line of any extent was laid down between Berlin and Halle, a distance of 105 miles, and was found to work so satisfactorily that the system has since been very largely extended, until at the present time a perfect network of underground lines connects all the important cities and towns of the empire, and the aerial lines have been practically superseded. The lines are laid in trenches, some three feet underground, and consist of a number of copper wires twisted to form a cable, and covered with two layers of Chatterton's compound and two layers of gutta-percha, placed alternately, the wire being first covered with Chatterton's compound.

In this country there are, up to the present time, so few underground lines in operation, that the system may be said to have no existence, and the streets of our cities and towns are still defaced by the unsightly posts and wires, against which we have so often and so decidedly protested. That this indifference is willful, is completely proven by the almost complete abandonment of the obnoxious aerial system in the cities and towns of Europe.

The Brooks' system, which we believe is the only one in use in this country—in several short lines, one between Jersey City and Newark, and another in the city of Philadelphia—is an exceedingly simple and efficient one, and on these accounts, as well as on the score of cheapness, leaves little to be desired. The plan of Mr. Brooks consists in placing the covered wires in iron pipes filled with paraffin oil. The leakage of the pipes is provided for by means of stand pipes placed at intervals along the line. The wires—any number that may be desired—are simply covered with hemp, and drawn through the pipes without any special provision against their mutual contact, experience having shown that the insulating qualities of the paraffin oil are so perfect as to obviate all danger from local induction and the grounding of the line. The practicability of the Brooks system has been fully established, and as the report has been circulated that the patent rights of the inventor were acquired by the Western Union Telegraph Co. some years ago, it was hoped that the system might be introduced to take the place of the post and wire system in our cities. Thus far, however, nothing looking to this end has apparently been done; and unless the authorities of our cities take decided measures and insist peremptorily upon the banishment of the nuisance of posts and wires, it is hardly to be expected that any change for the better will be made.

In the light of the facts here presented, it is little less than ridiculous to see in some of the technical papers statements to the effect that the underground system of telegraphy is as yet an experiment. It is, and has been for years, a reality. It is the telegraphic system of the future.

The Nickel-Plating Patent Suits.

The judicial history of the Adams process for nickel-plating affords one of the most convincing arguments in favor of some such radical change as that we lately proposed in our editorial on the "Evils of Expertism," (see page 219 of our October number for 1880), in the methods of determining judicial decisions in cases involving special scientific and technical knowledge. In our criticisms upon this case, we wish at the outset to distinctly disclaim all intention of reflecting in the slightest degree upon the intelligence or the thorough honesty of the judge to whom the duty of passing judgment on the cases fell. It is, in fact, the system that is at fault, that compels a man to pass judgment upon subjects concerning which he is but imperfectly familiar. Under such circumstances, if a mistake is made, as we believe has been made in this case, the system, not the judge must be blamed. The judge may be ever so upright and keenly aware of the responsibility of his situation as arbitrator in a subject involving important commercial interests, and yet the most prudent exercise of the judicial faculty in cases demanding special scientific knowledge, will occasionally work hardship where a mistake is made. This is undoubtedly what has happened in the case of the now celebrated nickel-plating suits, the history of which is sufficiently instructive to invite rehearsal.

About the year 1870, a certain Dr. Adams secured letters-patent of the United States for a process of plating with nickel, which claimed the use of a double salt of nickel in a solution that should be made perfectly neutral with ammonia. The presence of other alkalies—soda or potash—in the nickel bath, was distinctly claimed to be hurtful, and the neutral character of the bath was insisted upon as *sine qua non*. It may as well be remarked just here that practical processes for plating with nickel had been named and described in many of the scientific and technical journals years before the patent to Dr. Adams had been granted; but such accounts and descriptions had attracted little or no attention, for the reason that the practice of nickel-plating had at the time acquired no commercial importance. Shortly afterwards, however, the art became very popular, and a number of methods for operating it came into use. The patent of Dr. Adams about this time passed into the control of a wealthy and powerful company, which forthwith brought suits against the parties who were plating with nickel, claiming that the Adams process which they owned was the only one by which nickel-plating was practicable, and that therefore those who were doing work of this description, must be infringing upon their patent. After much litigation, to the surprise of every one in the least acquainted with the subject of chemical technology, and with the very narrow limitation of the Adams patent, the court rendered a decision which practically gave the company owning the Adams patent the monopoly of the nickel-plating business of the country, by substantially affirming the claim set up by them—that theirs was the only process by which it was practicable to plate with nickel. The grievous injustice of this decision, no less than the astounding ignorance which it manifested on the part of the judge who uttered it, attracted at the time much unfavorable comment from scientific men. They knew full well that Adams had never invented anything; that the process he claimed to have invented had been substantially described in the technical papers years before Adams ever thought of it; and that the limitations as to the presence or absence of certain alkalies, and as to the neutrality of his plating solution, were nothing more than evidences of his lamentable ignorance of the chemistry of the subject of his patent. In spite of these facts, however, the judgment of the court was given in favor of the extravagant claims of the owners of the Adams patent, and every one practicing the art in the country was compelled to pay tribute.

The errors of this judgment, however, were so glaring that it was impossible for it to be long maintained. It was soon shown that the limitations which the Adams patent made, and upon which the owners of the patent based their pretensions that it was the only practicable method of nickel-plating, were positively and ridiculously wrong, and the judge who had passed upon the case, was obliged to reverse his earlier decision in the face of the practical demonstration of his error.

A succinct history of this capital case is given in the following editorial, taken from a late issue of the *Iron Age*, which, as our readers will perceive on perusal, fully takes in the whole situation:

"The case of the United Nickel Co. *vs.* Chas. G. Pendleton, for an alleged infringement of the Adams patent, has just been argued before Judge Blatchford in the U. S. Circuit Court of this district. About the first of April most of the licenses issued by the United Nickel Co. expire, and it is, consequently, a critical point in the business of the United Nickel Co., as well as that of all who work under their licenses.

"The first suit against Pendleton to suppress the acid solution was begun in January, 1880, the complaint being that Pendleton was in contempt for violating an injunction by continuing to plate with nickel, in alleged violation of the Adams patent. In April Judge Blatchford rendered his decision as follows:

"'*Circuit Court of the United States for the Southern District of New York.*

THE UNITED NICKEL CO.
vs.
CHARLES G. PENDLETON.

"'BLATCHFORD, J.: It is not shown that the defendant did any practical plating by the use of the double acetate of nickel and ammonia, while the evidence on the part of the defendant shows that he did not use such solution for practical plating. As to the bit, it is shown to have been plated in a solution of the simple acetate of nickel. The plaintiff has introduced no evidence as to that solution. So there is nothing on which to found an attachment for contempt, as there is no case for a decision on the merits as to anything.'

"In the present case the position taken by the plaintiffs in the contempt suit has been abandoned. They now concede what previously they stoutly denied, that plating in a solution giving a strongly acid reaction is possible, and they admit that Pendleton is doing it, but they claim that he cannot do so without infringing the Adams patents. Since the decision was given in his favor in the contempt case, Mr. Pendleton has patented his invention, and sold large quantities of his solution, charging no license fees. This competition is a serious matter to the United Nickel Co., but probably it was considered politic not to bring the alleged infringement to the test of a trial on its merits until about this time of the year, when proceedings against Pendleton would have a much greater effect upon nickel platers working under the United Nickel Company's licenses than if brought earlier or later.

"Exactly what Dr. Adams and his business associates are entitled to claim is a much discussed question. Primarily, he did not discover the art of nickel-plating. That he did patent a method of nickel-plating by which satisfactory commercial results were attainable, is admitted by everybody. Probably the double sulphate process was the first used by which a regulus deposit could be obtained on a commercial scale. But whether his claim to a regulus deposit of nickel is good, independently of the means by which he obtained it, is, we should say, the main question involved in the case now under consideration. Dr. Adams believed that to secure such a deposit the nickel solution must be made neutral with ammonia. On this point his patent claims are very specific. Weston discovered that a basic solution could be made to do the work, and to avoid any trouble from this source the Weston patent was purchased. Pendleton found by experiment that it was possible to plate cheaply and satisfactorily in an acid solution composed of water, acetic acid and the oxide of nickel, and that its utility depended upon its having a strongly acid reaction. If rendered neutrai or alkaiine it would be worthless. In fact, Pendleton did what Dr. Adams said could not be done, and what he so fully believed to be a chemical impossibility that he not only neglected to cover himself on this point, but took pains in his specifications to warn those 'skilled in the art,' that unless a tendency to acidity in the solution was counteracted and it was made quite neutral, it would not work. He was entirely mistaken on two points—with regard to a basic solution and with regard to an acid solution: One of these mistakes was rectified by the purchase of the Weston patent; the other still stands in his way. This, as we understand it, is a brief statement of the essential facts of the case as submitted to Judge Blatchford, and as very important interests depend on this decision, it will be awaited with impatience by the whole trade."

As we remarked at the outset, the history of this case affords the most striking and convincing proof of the necessity of introducing a radical change in the method of determining judicial decisions respecting subjects involving special scientific and technical knowledge. It is absurd to assume that a judge, because he is learned in the law, is therefore competent to pass judgment upon subjects concerning which he is practically ignorant. Such cases as this show very clearly that some reform of the nature of that proposed in our former editorial is imperatively necessary.

Economy in Steam Boiler Practice.

Our attention was lately called to some simple and novel appliances employed at the Brooklyn Oil Works, Hunter's Point, which are worthy of special notice from the convenience and the notable economy which they realize in practice. We refer specially to the tar burners used in connection with the Babcock & Wilcox boilers for burning the refuse tar of the stills, of which an abundance is made at the refinery in question, in place of coal. The attempt has frequently been made to devise a practical method of utilizing residual products of this kind at gas works, refineries of petroleum, and other industrial establishments; but thus far no very remarkable success has attended these efforts. The method here referred to, however, gleaned from personal inspection, and from facts pertaining to the present cost of operating the boilers, appear to be convincing in establishing the practical success of the method of tar-burning there in operation.

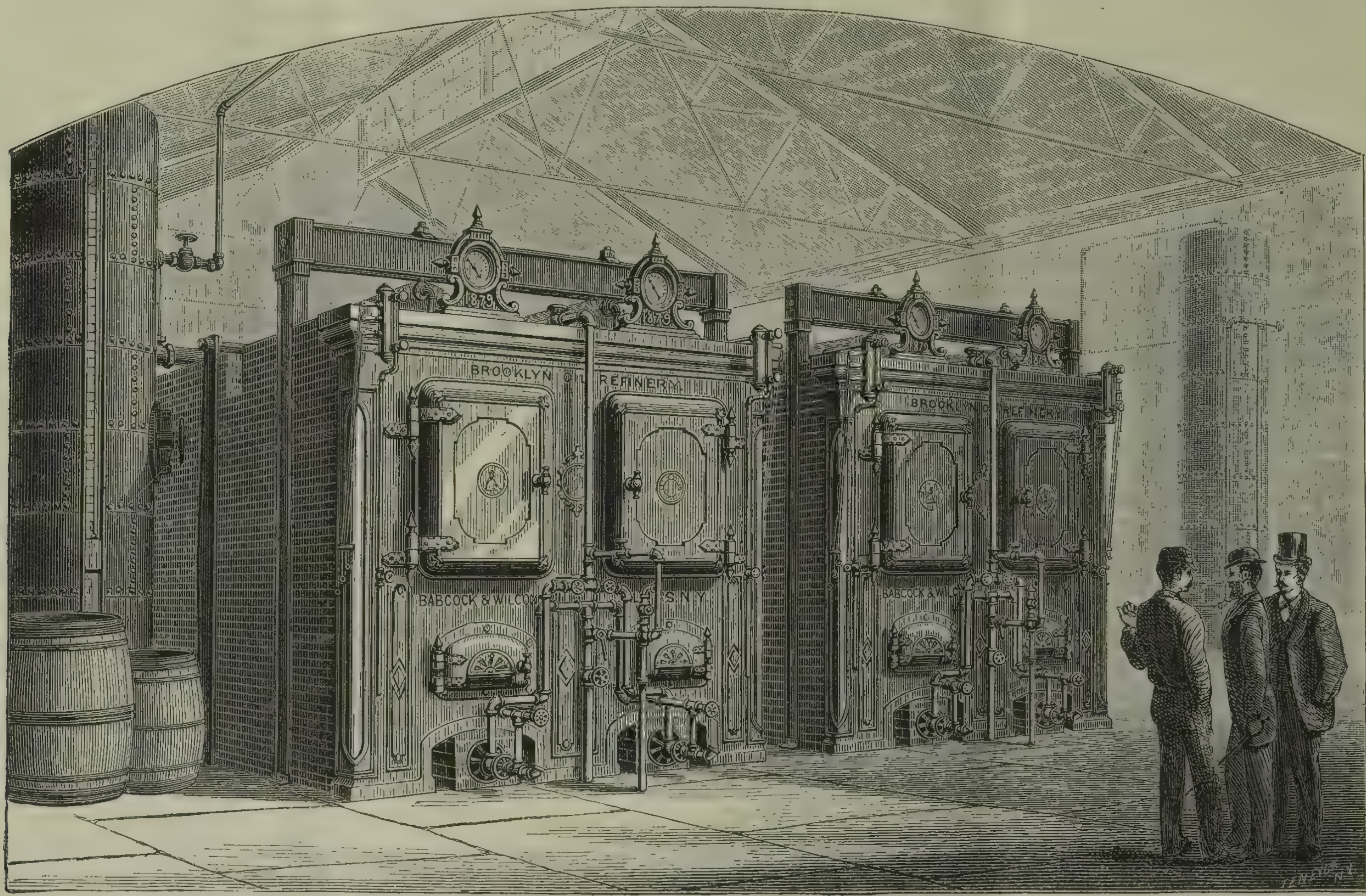


Fig. 1.—Method of Burning Petroleum, Refuse, Tar, etc., as Used with the Babcock & Wilcox Boilers at the Standard Oil Co.'s Works, Brooklyn, E. D.

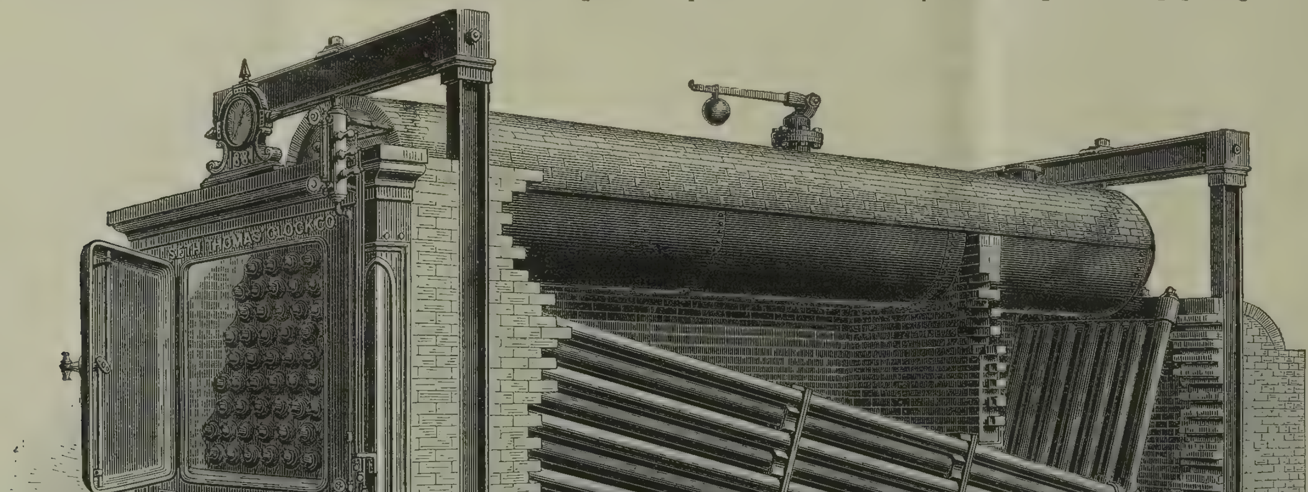


Fig. 2.—Sectional Perspective View of a Babcock & Wilcox Boiler.

The apparatus is the invention of Mr. H.E. Parson, Superintendent, and Mr. Geo. V. Northey, Engineer, of the Watertown Steam Blower Co., of Watertown, N. Y., (whose offices are at 42 Pine street, New York). This company make a specialty of various devices for utilizing waste products in all kinds of factories. They have a steam blower for burning the different varieties of slack coal, spent tan-bark, sawdust, screenings, peat, or any kind of tarry matter. This blower is used for forcing a blast under and through the grate bars, and as such has wonderful capacity. It is a power within itself, having no shafting, gearing or machinery, giving a blast sufficient for boilers varying from 3 to 200 horse-power, and being under perfect control.

The high heating power of some of the waste materials mentioned, and their low cost as compared with

coal, makes the question of their employment as a substitute for the latter, one of special importance on economical grounds where circumstances place the material in quantity at disposition. As we have already stated, our comments in the present article will be confined to the tar-burners, at the Brooklyn refinery, where they have been in use for the past 18 months for firing a set of four Babcock & Wilcox boilers, of 100 horse-power each, and with the result of having given complete satisfaction as to ease and reliability of operation, and of having demonstrated a notable economy. This make of boiler is peculiarly adapted to this fuel, by reason of the thin heating surface and absence of all joints in the fire, enabling it to withstand the very intense heat generated, under which ordinary shell boilers are rapidly destroyed.

Referring to the arrangement of the burners, the tar, which is sufficiently fluid for the purpose, is allowed to run down through a pipe provided for the purpose, from an elevated reservoir. At the proper point, the tar is met by a steam jet, by which it is atomized and carried with great energy into what corresponds to the ordinary fire space of the boiler. The energy of the impelling steam jet induces simultaneously the entrance of sufficient volumes of air through openings provided for the purpose, to allow for the combustion of the tar and the thorough intermixture of the combustible with the oxygen of the entering air, while the method secures a very perfect and intense combustion. Grate bars are, of course, unnecessary, and are dispensed with. The operation, as witnessed by us, was perfectly automatic, and appeared to require no special supervision, the supply of steam and the flow of tar simply requiring regulation from time to time, as more or less steam was needed, which was effected by the turning on or off a stop-cock controlling the supply of the one or the other. The action of the arrangement under the proper adjustment of parts is, therefore, perfectly regular and automatic. The tar is burned without a particle of smoke and with a very intense heat. No dust is produced—in fact, it is a perfect fire.

In considering the question of the economy of this arrangement, a notable element, aside from the prime question of the relative cost of coal and tar consumed per pound of water evaporated, is the material saving of labor, in being able to dispense with the attendance to fires, removal of ashes, and other items of this kind which firing with coal demands, and which, where a number of large boilers are in constant operation day and night, as in the case here alluded to, is no inconsiderable one.

The best evidence of the economy of this method of firing, is afforded by the performance of the boilers. Fortunately for the correct estimate of this factor, the superintendent of the Brooklyn refinery, Mr. Hildebrandt, has kept an accurate register day by day of the amount of water evaporated and of the number of gallons of tar consumed, from which we are able to make a direct comparison with their performance with coal.

We give below the log of the attendant in charge of the boilers, for twenty-four hours, which we are informed represents an average daily performance: Tar consumed in 24 hours, 75 barrels, at $1 per bbl.=$75; water evaporated, 358,400 pounds. To estimate the evaporative value per pound of combustible, we may take 75 barrels of tar, of 40 gallons each, equal to 3,000 gallons, which, at 7 pounds per gallon, would give as the number of pounds of tar consumed, 21,000. The evaporation would therefore be

$$\left\{\frac{358400}{21000}\right\} =$$

17 pounds of water per pound of tar.

This evaporative effect greatly exceeds that obtainable with coal, in explanation of which it may be remarked that, in addition to the very perfect combustion which the blower insures, as before explained, the heating power of the tar is considerably greater than that of coal. A comparison of the above results with those obtainable with the use of coal as fuel, will be highly instructive, and is given in the following tabulation:

75 barrels tar, at $1 per bbl.............$75
To do the same work, would require on an average 20 tons of coal, at $4.50....... 90

(20 tons of coal, at 2,240 lbs.=44,800 lbs.) and the evaporation per pound of coal would be

$$\left\{\frac{358400}{44800}\right\} = 8 \text{ pounds.}$$

Evaporation per pound of tar=17 pounds.

The effectiveness and economy of this method of firing seems, therefore, to be fully demonstrated.

It may not be out of place to make an allusion to the boilers in connection with which the above described tar-burners have been so successfully applied. Many of our mechanical readers will recognize the Babcock & Wilcox boiler at once in the accompanying engravings; and the only essential modification adopted in employing the tar burners, consists in dispensing with the grate bars, and in providing suitable openings for the free entrance of air into the fire-space.

It will be unnecessary for us to dwell in this place upon the special peculiarities that have gained for this style of boiler a high reputation in respect to great economy and practical immunity against the danger of destructive explosion, since we have repeatedly presented these facts in detail. We will only add, in order to bring out in stronger contrast, the very high evaporative power developed by the use of tar in the Parson tar-burners at the Brooklyn refinery, the following records of the performance of the Babcock & Wilcox boiler, under strict test conditions. The evaporative duty shown in the following table will be at once recognized by steam users as being exceptionally good.

TESTS OF BABCOCK & WILCOX BOILERS.

	Water evaporated in lbs. from and at 212° Fah. Per lb. of coal.	Per lb. of combustible.
At Centennial Exhibition	10.75	12.131
" Raritan Woolen Mills	9.798	11.227
" Harrison, Havemeyer & Co.	9.712	11.601
" T. A. Edison	9.4	11.365

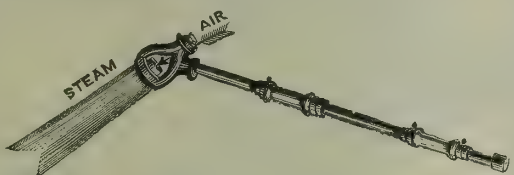


Fig. 1.—Parson's Air-Jet Tube-Cleaner.

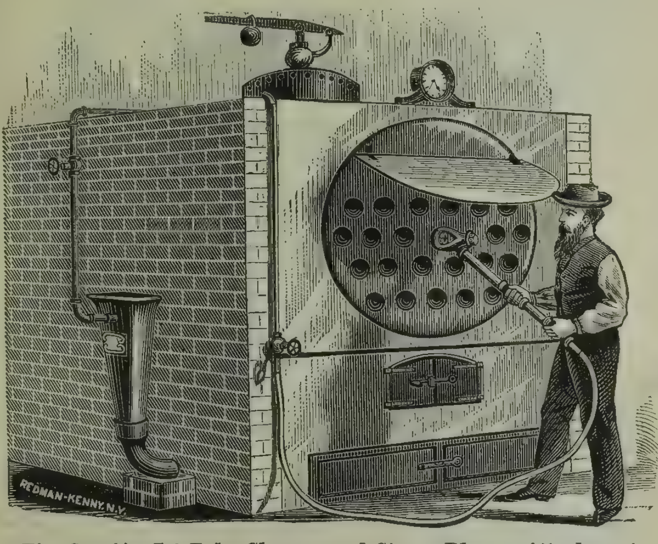


Fig. 2.—Air-Jet Tube-Cleaner and Steam Blower Attachment.

Parson's Air-Jet Tube Cleaner.

We give here an illustration of Parson's air-jet tube-cleaner, manufactured by the Watertown Steam Blower Co., of 42 Pine street, New York, whose admirable arrangements for utilizing waste products as fuel we have described in the preceding article. All users of steam boilers are aware of the difficulty of properly and speedily cleaning the tubes of boilers of soot, ashes, scale, etc., and many devices have been brought forward for the purpose. The Parsons air-jet tube cleaner is affirmed to be very effective for this and similar purposes. The apparatus is shown in Fig. 1, and the method of using it in Fig. 2. The inventor, in this device, claims that its efficiency largely depends upon the manner in which he has succeeded in utilizing the expansive power of air, which is carried into and through the tubes. To this end he delivers from the orifice of the apparatus a thin ring of steam, in such a manner that the angles of delivery form a wedge or cone-shaped surface, inducing and holding a strong central air current, which, being forced through the heated tubes, expands as it travels, and carries with it all the accumulations of soot, ashes, etc., that have found lodgment therein. In using the apparatus, it is recommended that the steam should be taken from as near the top of the dome as possible. A piece of strong flexible tubing, connecting the steam delivery pipe with the apparatus, is necessary, as shown in the cut, to enable the operator to move from tube to tube. With this apparatus, it is claimed, that ten tubes per minute can be cleaned, while the boiler is running.

This device, we are informed, has been extensively introduced into a number of large industrial works throughout the country, and in all cases has demonstrated its utility.

Steel.

The Boston *Journal of Commerce* objects as follows to the very miscellaneous application of the term "steel." The "low steel," "mild steel," "Bessemer steel," and other names by which partly converted iron is known, ought not to be called "steel." The name is a misnomer, and it has recently been earnestly advocated at a meeting of manufacturers in England to propose and introduce a new nomenclature which should more definitely designate the different qualities of iron in its commercial form to steel in its various grades, and as adapted to various uses. It would be well if such a recommendation could be universally adopted and generally acted on. At the present the public is greatly misled by the use of the term "steel," in designating the substance of which razor blades and railway rails, surgical instruments and steam boilers, pocket-knives and Krupp's guns are made, as though the same material were used in one and all. Nothing could be more misleading. The steel plates of a boiler or ship's side have no more in common with the plate-steel from which saw blades are formed than nickel has with copper. And many other illustrations might be given to show the great divergence of the same quality held in common, and the number of qualities not possessed in common by the material coming under the single denomination of "steel."

Ashes as Emery.—A manufacturer whose business requires the use of large amounts of emery, has been trying an experiment with the ashes of anthracite coal, and he affirms that he has obtained good results from the use of ashes as a substitute for the finer grades of emery. He takes ashes and saturates them with water, the liquid being poured off after standing an hour or two, then being poured off again, and so until he obtains several grades, down to a substitute for emery flour. When dried, the deposit cuts readily and leaves a satisfactory surface.

An Improved Filter.

We give herewith illustrations and description of an improved filtering apparatus, manufactured by the Crocker Filter Co., of 174 High street, Boston, Mass., which has some excellent features, that recommend it for the filtering of water for domestic and manufacturing uses. The number of filtering devices that have been offered to the public is legion, but while some of these may meet the requirements of practice reasonably well, the great majority have no permanent utility, as they speedily become ineffective or inoperative. From personal experience many of our readers will know how unsatisfactory are the devices that have been invented for household use; and in many manufactories, as, for instance, in breweries, paper and starch factories, bleacheries, dye houses, laundries, etc., where cleanliness and purity of the water used are absolutely essential, the use of large settling tanks is adopted because of the want of reliance in the filtering apparatus in vogue. Steam users are frequently compelled to adopt a similar practice to prevent the too rapid accumulation of sediment in their boilers. This is especially true in many parts of the West, where the water is often so heavily charged with mud and other mechanically suspended impurities as to be quite unfit for use. For these reasons, a thoroughly practical filtering apparatus, that will rapidly and perfectly remove the organic and earthy impurities from water intended for domestic or manufacturing uses, and which can be relied upon not to become worthless after a brief service, will meet a great want.

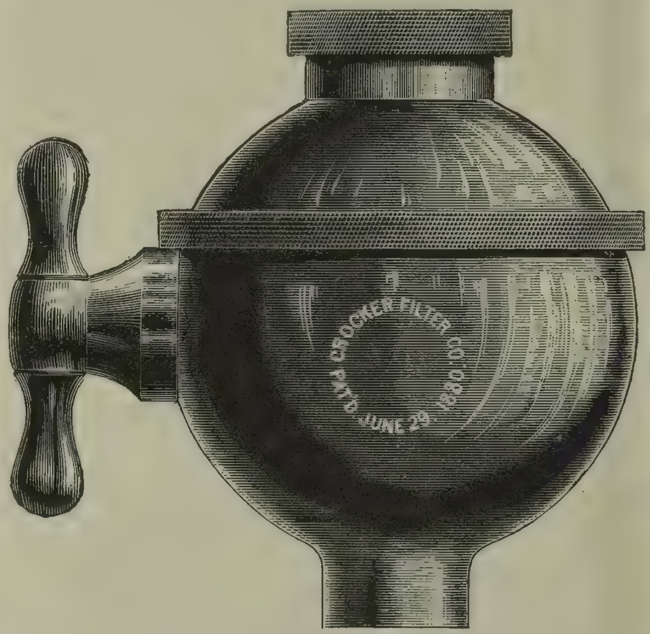


Fig. 1.—Crocker Reversible, Self-Packing and Self-Cleansing Filter—Exterior View.

The makers of the filtering apparatus herewith illustrated, claim that it meets every practical requirement of the case fully and satisfactorily. The following description of the construction and action of this apparatus will give a fair idea of its merits: Fig. 1 represents an exterior view, and Fig. 2 a partial sectional view of the Crocker filter, designed for domestic use, for steam users, for attachment to main water pipes in private dwellings, hotels and public buildings, and in all manufacturing establishments requiring perfectly clear water. They are made in sizes from 10 to 48 inches diameter.

This apparatus provides for filtering the water by passing it through two fine wire-cloth strainers, and a body of fine animal charcoal, which last is acknowledged to be the best filtering and purifying material that is known. Referring to Fig. 2, the apparatus is seen to consist substantially of a reversible globe or ball carrying the filtering material, contained in an outer metallic case, which is to be attached to the faucet or water-supply pipe. Referring to the lettering, A A represents the packing of the stem; B, a stop to prevent the ball from turning entirely over; C C, packing of ball and outer case; D, a free passage for water without filtering; E, strainer; and F, the filtering material.

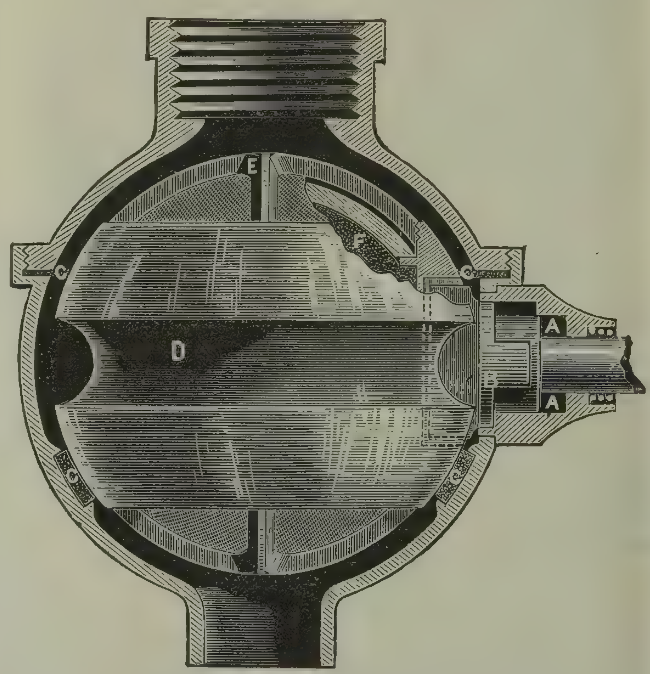


Fig. 2.—Crocker Reversible, Self-Packing and Self-Cleansing Filter—Sectional View.

The following directions are given for using and renewing this apparatus: For filtering, the handle should be placed horizontally. To pass the water through without filtering, the handle should be placed in a vertical position. It is recommended, after using the filter for a time, to cleanse the apparatus by shutting off the water, reversing the ball, and letting on the water, when the accumulation of impurities is washed out. The oftener this operation is repeated, the cleaner will the apparatus be kept, and the longer will the filtering material retain its purifying qualities. When the latter loses its vitality, which it will in time, the old material can readily be removed and replaced by fresh, by simply removing the cap with the wrench that accompanies the apparatus, taking out the ball, when, with the same wrench, the strainer may be removed, the old material emptied out, and fresh material substituted. The parts may then be replaced as before, and the apparatus is renewed.

The makers claim for their apparatus special features of merit for the following reasons: The manner of packing at the bottom in combination with the manner of holding the ball containing the filtering material with a loose joint between the same and the reversing handle, makes it certain that there will be no leakage around the ball (the pressure of water seating the ball firmly in its position), and that it will always reverse as easily as when first put into use, thus insuring thorough cleansing and avoiding the danger of becoming foul. The stem or handle for reversing the ball being so made and packed that the pressure of water serves to make it tight, the annoyance of a leakage around the same is avoided. The strainers, which screw into the ball, are so made that the water is divided into four streams as it passes into the ball, thus securing circulation throughout the same and preventing boring through the center. The wire netting is so secured to the frame-work as to be strengthened and protected thereby, and is removed with it by the little wrench which accompanies each filter, thus making the matter of refilling easy for any one, no matter how inexperienced.

These filters are made of a number of sizes, to adapt them for all purposes where such an apparatus may be found useful, whether for domestic or industrial uses. The makers have an improved device by which their filter may be attached to smooth faucets not provided with a screw end. They likewise provide their agents with full supplies of prepared animal charcoal, from whom purchasers may obtain a supply as it may be required. The apparatus appears to possess a number of meritorious features, and to be worthy of the attention of householders and manufacturers.

Any additional information will be willingly afforded by the manufacturers.

Malleable Castings.

Considerable pretense of mystery is assumed by manufacturers of malleable castings, both in this and the old country; and doubtless there are some trade secrets of value to those in the trade relative to mixtures of different irons, etc., but the process is in itself simple, and a little experience should enable any foundryman to attain a creditable success in it. Nearly every founder has his own mixtures and methods, but they are all based upon the processes of Samuel Lucas, of Dronfield, which date back to 1811. The general features of the process, as carried out by the Birmingham (England) iron founders, is given in the *Ironmonger* as follows:

"For the purpose of the casting, pig of a fine quality is needed, and great care is used in the preparation of the molds, so that there may be no flaw or imperfection in the casting. The latter, after cooling, is of course hard and brittle, and it is to remove this brittleness and give it the character of malleable iron that the special process is required. The casting is now placed in hermetically sealed pots or boxes, surrounded by powdered ore, and subjected for several days to intense heat, which, by cementation, gradually softens it and renders it malleable to the core, when it may be bent or wound into any shape. The annealing process takes ordinarily about ten days. Thus, a pot made up on Tuesday is got up to a white heat about Friday, and this heat is maintained for some twenty-four hours or more, according to the size or thickness of the article annealed. The fire is then allowed to die down, and when the mass is cool the castings are found thoroughly annealed and malleable. Scarcely a trade in Birmingham fails to use malleable castings for some purpose or another. The introduction of Bessemer steel has somewhat operated against the trade, but there is still a great field for malleable iron founders in catering to the requirements of the Birmingham gun, harness and engineering trades."

The journal quoted thinks it much to be regretted there is not a more free interchange of ideas and experience among English iron founders, as in this only is there hope that the English trade can keep pace with German and French progress in the art.

BEET SUGAR.—As a producer of beet sugar, France takes the lead among the countries of the world. Then follow, in the order named, Germany, Russia, Belgium, Austria, Holland, Sweden and Italy. The manufacture of sugar from beets is daily assuming more importance in the United States. At present 90 per cent of the 1,900,000,000 pounds of sugar of all kinds annually consumed in the United States, comes from abroad. The sugar brought into this country constitutes about one-half of the total value of our imports.

A Decided Improvement in Wash-Basins.

We invite the attention of our readers to the accompanying engraving of the latest form of the Wellington basin, embodying a number of excellent features which recommend it highly to the attention of architects and householders. As will be seen by consulting the engraving, the basin proper is provided with an outside safety-shell of white enameled iron. Within this is placed the earthenware bowl, in such a manner as to leave a space between the two, which permits of the unobstructed outflow of the overflow water over the entire upper surface or rim of the basin underneath the marble top. The overflow water then passes off between the outer shell and the bowl, and through the trap below.

The Wellington basin is connected to the marble slab by means of clamps of peculiar construction, which permit of the basin being instantaneously attached or detached at pleasure by turning the basin to the right or left. The joint between basin and slab is made water-tight by the use of an adjustable water-proof packing, plaster or putty being entirely dispensed with. The bottom of the basin terminates in a slender neck, which projects somewhat into a hemispherical reservoir, which, as will be perceived, provides an effective water-seal or trap against the entrance of sewer gas. The shape and position of this trap are such as to render impossible its unsealing by siphonage, which often occurs with the common **S** trap.

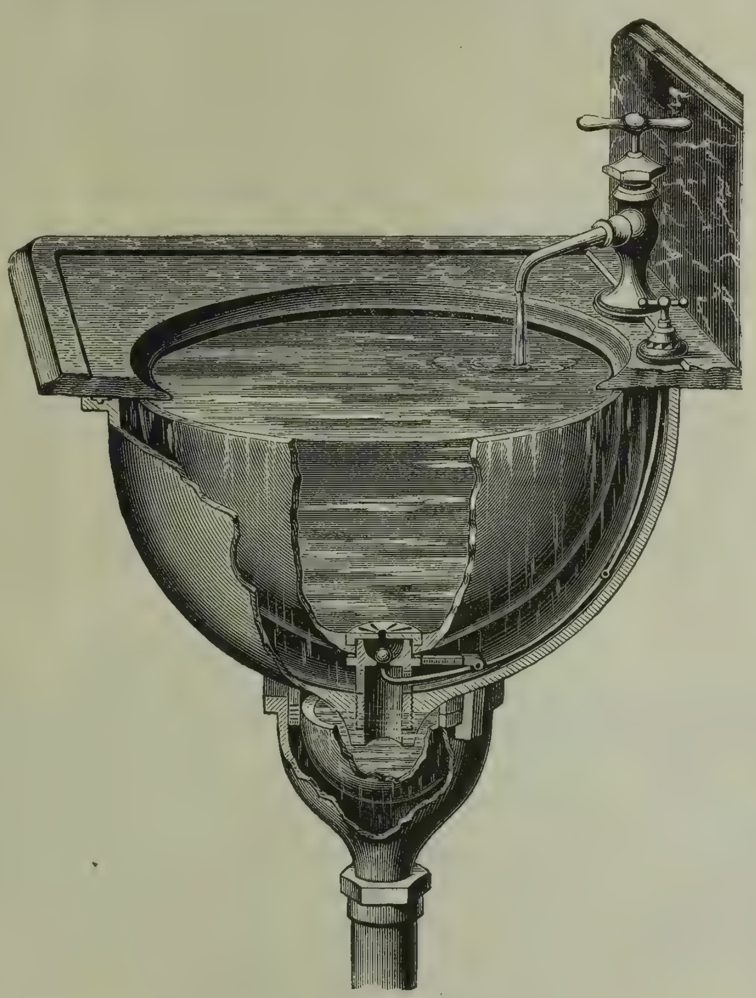
From the foregoing description, it will be noticed that the overflow is one of the special and meritorious features of this basin. It is not, as is usually the case, a narrow, contracted neck, attached to a small pipe by a putty joint which the slightest settling of the surrounding woodwork may disjoint and cause to leak; nor can the accidental presence of the corner of a towel stop the exit and cause flooding, as not infrequently happens with the basins in common use. On the contrary, the overflow here being over the entire rim of the bowl, is so ample that the basin may be used as a miniature wash-tub, filled with towels, handkerchiefs or laces, both cocks turned on full, without the slightest danger of damage from flooding.

A recent improvement that has been added to this basin materially increases its convenience and value. This is a simple device by which the troublesome chain and plug are dispensed with, and what is quite as important, without additional cost. Hitherto, it is asserted, all arrangements for doing away with the chain and plug have been so expensive that they have not come into general use. The arrangement adopted by the manuturers of the Wellington basin is simple, effective and not liable to derangement. It is entirely contained in and enclosed by the outside safety-shell of the basin. In the place of the ordinary chain-stay, is a cam enclosed in a metal cap, operated similar to a compression cock. This acts upon a rod that lifts from its seat a ball-valve when it is desired to empty the basin. When the cock is reversed, the ball drops back to its seat. This device is so well shown in the engraving that further description is unnecessary. The convenience of an arrangement of this nature will be fully appreciated by all who have been annoyed by broken chains and mislaid plugs; and the simplicity of this particular form of the device is one of its chief merits.

The manufacturers of this basin claim for it a number of special merits: 1. That the manner of attaching and packing the basin gives positive security against leakage; 2d, that the overflow is sufficient under all circumstances to carry off four times the delivery of any supply basin-cock in use; 3d, that the form of trap provided is an effective barrier against the entrance of sewer gas; 4th, that the trap and basin can be attached or detached by any intelligent person without the aid of a plumber; and 5th, that the ball-valve affords a far more convenient and satisfactory method of emptying the basin than the troublesome plug and chain in common use.

We are informed by the manufacturers that there are at present nearly 4,000 of the Wellington basins in use, all giving entire satisfaction. They have just been placed in the Grand Union Hotel and Hotel Belvidere, and are coming to be quite generally called for by architects for the furnishing of dwellings.

The manufacturers are Messrs. C. E. Robinson & Co., of 61 Beekman street, this city.



THE WELLINGTON IMPROVED BASIN.

TO MAKE SAND-PAPER, crush glass under a runner, and sift it into about six sizes; coat a good quality of Manila paper with thin glue, and dust the pulverized glass over it. Sometimes two coats of glue and glass are thus applied to the paper.

The Fire at Fay's Machinery Manufactory.

TO THE EDITOR OF THE MANUFACTURER AND BUILDER:

The enterprising firm of J. A. Fay & Co., of this city, are rapidly putting themselves in shape again since the severe fire by which their works were nearly destroyed on the 6th of March. Fortunately for the speedy resumption of work upon the orders which even the large facilities of the establishment hardly enabled the firm to keep up with, the fire spared their 100 horse-power Corliss engine and boilers, and their new shop. It was fortunate, likewise, that, anticipating some time since a continuation of their great rush of business, the firm had contracted for a large number of machine tools, selected from the manufactures of Pond & Co., Blaisdell & Co., Putnam Machine Co., Wm. Sellers & Co., and other well-known makers, to go into the new extension of their plant which they had commenced. These tools will be speedily delivered, and put into operation as soon as received. It will prove very gratifying to the numerous patrons who have sympathized with the misfortune of the firm, that they at once started up with the new shop saved, and at the time of writing had 150 men at work. They have likewise leased additional buildings, pending the re-erection of their own which the fire destroyed, with power sufficient to add 200 men more. The numerous patrons of the establishment may be assured, in view of this display of energy and enterprise, that the firm will only be temporarily delayed in filling their orders.

Within sixty days the firm expect to have their new building completed, which will give them a capacity of employing a force of 500 men. Before the fire, the firm of J. A. Fay & Co. were among the largest manufacturers of wood-working machinery and agricultural machinery in the world, and when rehabilitated with new and enlarged facilities, they expect to have an establishment of twice the size and capacity of any other in their line, and by the exhibition of the same qualities and enterprise that have earned them marked success in the past, to largely extend their patronage.

The principal purpose of thus briefly calling your attention to the establishment above named, is to advise its numerous patrons—many of whom are reached by the MANUFACTURER AND BUILDER—that the calamity which so unexpectedly overtook them will prove to be only a temporary embarrassment, and that no apprehension need be felt that their orders will not be filled promptly.

J. A. Fay & Co. are representative American manufacturers. In the excellence of their machinery, as regards boldness and originality of design, and quality of workmanship, their reputation is second to none at home; and these qualifications, backed by commendable enterprise, has carried the reputation of their products abroad, and the firm is to be congratulated for having done their full share in contributing, by their products, to the esteem in which American machinery is held in European countries.

Cincinnati, O., March 25, 1881. X. Y. Z.

Microscopic Structure of Malleable Metals.

The following observations on the minute structure of metals which have been hammered into thin leaves are instructive. Notwithstanding the great opacity of metals, it is quite possible to procure, by chemical means, metallic leaves sufficiently thin to examine beneath the microscope by transmitted light. Such an examination will show two principal types of structure, one essentially granular and the other fibrous. The granular metals, of which tin may be taken as an example, present the appearance of exeedingly minute grains, each being perfectly isolated from its neighbors by still smaller interspaces. The cohesion of such leaves is very small.

The fibrous metals, on the other hand, such as silver and gold, have a very marked structure. Silver especially has the appearance of a mass of fine, elongated fibers, which are matted and interlaced in a manner which very much resembles hair. In gold, this fibrous structure, although present, is far less marked. The influence of extreme pressure upon gold and silver seems to be, therefore, to develop a definite internal structure. Gold and silver, in fact, appear to behave in some respects like plastic bodies. When forced to spread out in the direction of least resistance their molecules do not move uniformly, but neighboring molecules, having different velocities, glide over one

another, causing a pronounced arrangement of particles in straight lines.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

Adrian Iselin contemplates the erection of a handsome store on his property at the corner of Greene and Canal streets. Its size is to be 25 x 100 feet.

The site for the new Metropolitan Opera House has been finally selected. It is the block bounded by Broadway, Thirty-ninth street, Seventh avenue and Fortieth street.

Mr. Hale, of Boston, has purchased the property on the northwest corner of Broadway and Duane street for $250,100, and is about to build an extensive warehouse there.

Work has begun on the foundations for a hotel to be built on the north-east corner of Sixty-second street and Boulevard, to have a frontage of 200 feet on the Boulevard and 83 feet on Sixty-second street.

W. & J. Sloane have leased from the heirs of the C. T. Williams estate the property at the southeast corner of Broadway and 19th street, 128 feet front on Broadway and 143 feet on 19th street. They have purchased adjoining land on 18th and 19th streets, and will erect a handsome six-story stone and iron building on the entire plot, which covers 20,000 square feet.

A very large apartment house is to be built for F. G. Hyatt on Twenty-third street, 200 feet west of Seventh avenue, having a frontage of 175 feet, and depth of 100 feet. The building which will be named the "Graham," will consist of seven or eight stories, brick and stone front, and is from the designs of J. H. Dudley. The cost will be about $600,000. All the rooms except the bedrooms will be finished in cabinet wood, the main staircase being of marble and wainscoted from top to bottom with red and black marble, an independent staircase for tradesmen being provided in Twenty-second street.

D. O. Mills has purchased the property on Broad street extending from the Drexel building to Exchange Place, fronting 165 feet on Broad street and 100 feet on Exchange Place, and running thence through Wall street, east of the Drexel building, where it has a frontage of 29 feet. Mr. Mills will immediately proceed to erect on this property one of the largest and best business buildings in the city, to be completed in time for occupation by tenants in May of next year. It will be designed for the use of bankers, with the upper stories for offices, will have entrances on Broad street, Exchange Place and Wall street, and will probably be nine stories high.

The brown stone front of the building No. 245 Broadway, formerly owned by Orange Judd, has been taken down, and a front of pressed brick, with stone trimmings, substituted. The stone-work over the windows and at each side of the windows, is handsomely carved, and the upper story has been carried up to a pediment. The extreme hight of the building, from the sidewalk to the top of this pediment, is one hundred and twelve feet. New floors have been laid in the building, and a well-hole made for light and ventilation. Elevators to run from the basement to the sixth or top floor will be built, and the building be heated throughout by steam. The structure has an "L" fronting on Murray street. The ground floor will be arranged as a store and the other floors for offices, about forty in all. The sixth story is to have an arched ceiling rising to the hight of twenty feet in the center, and above this will be a half story. The roof is arched.

The Manhattan Eye and Ear Infirmary building at Park avenue and Forty-first street, which is to take the place of that in Thirty-fourth street, is approaching completion. The new building is of red brick with Belleville stone facing, four stories high with basement. The two lower stories have massive iron beams and are finished with fine encaustic tiles. Turkish baths will be provided in the hospital. On the ground floor are the various rooms for the cliniques of the three departments connected with the hospital, the eye, ear and throat. The officers' rooms are also on this floor and will be fitted up with hard wood. The second story will be furnished for surgical operations. The two next floors will be devoted to the patients. A dining-room is on each floor. The large kitchen is on the fourth story. The main staircase is of polished oak, and every part of the hospital is exceedingly well lighted. It has a frontage of 60 feet and is 100 feet deep. The cost of land and building will be about $100,000. The institution is principally indebted to C. R. Agnew and ex-Gov. Morgan.

John Correja, architect, has completed plans for a three-hundred-thousand-dollar building on Rose street for George Munro. It will be built of red brick, with light-colored New-England granite trimmings. The structure will have a frontage of 92 feet and be 104 feet deep. Above the sidewalk it will have nine stories and in hight be 130 feet, while below the street level there will be two stories, with a depth of 20 feet. Above the first floor the front of each story will be pierced by nine windows, and as the establishment is not to join with the other buildings on Rose street, the sides will have eight windows in each story. The walls at the base will be 4 feet thick, and the thinnest portion in the ninth story, 2½ feet. At either end, in front, there will be built a hatchway for a freight elevator, from the cellar to the roof, and at the rear of the main stairs there will be a passenger elevator. The floors are to be constructed of heavy wrought-iron beams, placed 3 feet apart, with brick arches between. No woodwork will be used in the construction of the building. The stairs, doors, window-frames, sashes, etc., will be entirely of iron. On the roof a tank will be built with a capacity of 25,000 gallons. From here there will extend 2½-inch fire-lines clear down to the cellar. Outside the building, in the rear, a boiler-house will be erected for seven boilers, each 5½ by 15 feet. These will furnish heat to the establishment and power to one single engine of 600 horse-power, and to a double engine with a combined strength also of 600 horse-power.

As already briefly noted in this department, Eugene Kelly, the banker, is about to erect a building at the south-west corner of Beekman and Nassau streets, which is to cost about $400,000. The plans have been completed by Stillman & Farnsworth, architects. The structure will be 103 by 100 feet—covering the entire block on Beekman street, between Nassau street and Theater alley. It is to be ten stories high, with cellars underneath. It will be constructed of granite up to the third story, above which it will be of Philadelphia brick, laid in red mortar, with Dorchester stone trimmings, and terra-cotta panels between the windows. Each of the two fronts will be divided into three portions. The two outer portions are to be bounded by piers three feet eight inches in width, between which, on each story, will be grouped three windows of the ordinary size. The central portion will be pierced by three large double windows, each seven feet in width. Those between the fifth and sixth stories will be arched over and richly decorated. Between the sixth and seventh floors of the central portion of the front will be an elaborately wrought stone cornice, above which will rise a mansard roof three stories high. The two outer portions of the walls will be carried up straight through ten stories, the piers terminating in octagonal pinnacles, and the whole capped with an octagonal slated roof. The windows are to be all covered with lintels of stone, except on the top stories, where there will be decorative arches. The twenty-six feet of front on Beekman street will have three openings of equal size, two of which will be windows, and the third, in the center, the entrance to the bank. The main entrance to the building is to be on Beekman street, and will consist of an arched opening eight feet in width, furnished on each side with red granite polished and fluted pilasters, with molded bases and carved capitals supporting an architrave. Above this will be an ornamental cornice with pinnacles and an iron balustrade. The granite work is to be all smooth-hammered, except the piers, which will be each ornamented with a rock-face panel. This treatment will extend over the Beekman and Nassau street fronts, and will be retained down Theater alley for a distance of about thirty feet. The remainder of the Theater alley front will be laid plain with croton-faced brick and blue-stone sills and lintels. The interior of this magnificent structure will consist of cellars, a first floor on the level of the sidewalk, eight floors for offices and a tenth floor for the use of the janitor, and for dining rooms for the companies which may become tenants. The building will be heated with steam by direct radiation in the rooms on the office floors, and by indirect radiation on the first floor. All the floors are arranged alike above the first. All modern conveniences will be furnished.

C. C. Haight, the architect, has just finished plans for the new Columbia College Law Building, to be erected at once and to form another division of the series of buildings which will eventually cover the whole block between Forty-ninth and Fiftieth streets, Madison and Fourth avenues. The building will face on Forty-ninth street and be in the center of the block. The frontage will be 120 feet and the depth 90 feet. The style will be similar to that of the Madison avenue building already erected and much admired. The materials will be brick and red sand-stone, and the style English collegiate gothic. In the interior no plaster will be used except for the ceilings, the bricks showing in the walls. Back of this new structure will be the chapel, which cannot be erected yet because it would necessitate the destruction of buildings in daily use and indispensable. Between the chapel and the law buildings there will be a covered brick archway, giving a passage between the two courts into which the new building will divide the block. From this archway the stairs will lead to the upper stories. The basement of the Law Building will be given up to the cloak-room and private offices of the law school. The first floor will contain two large lecture rooms, and the two professors' private rooms. On the second floor will be the library of the college, an irregularly shaped room covering a space equal to 120 x 60 feet. The alcoves and books on the floor of the library will be open to the students, the more valuable books being placed in the galleries which will be run all around the hall. At the rear of the library and over the passage-way spoken of will be an especially secure place for rare books which can be reached only by passing through the librarian's private room. The libraries united in this building will be those of the college proper, the school of mines and the law school.

Miscellaneous.

The trustees of the Michigan Avenue Baptist church at Chicago, have decided to reorganize and build a new edifice.

W. F. & John Barnes, of Rockford, Ill., are about to erect an addition to their works which will increase their capacity about one-third. They employ 65 hands, are full of orders for foot-power machinery, and will soon bring out some new styles of lathes and drills.

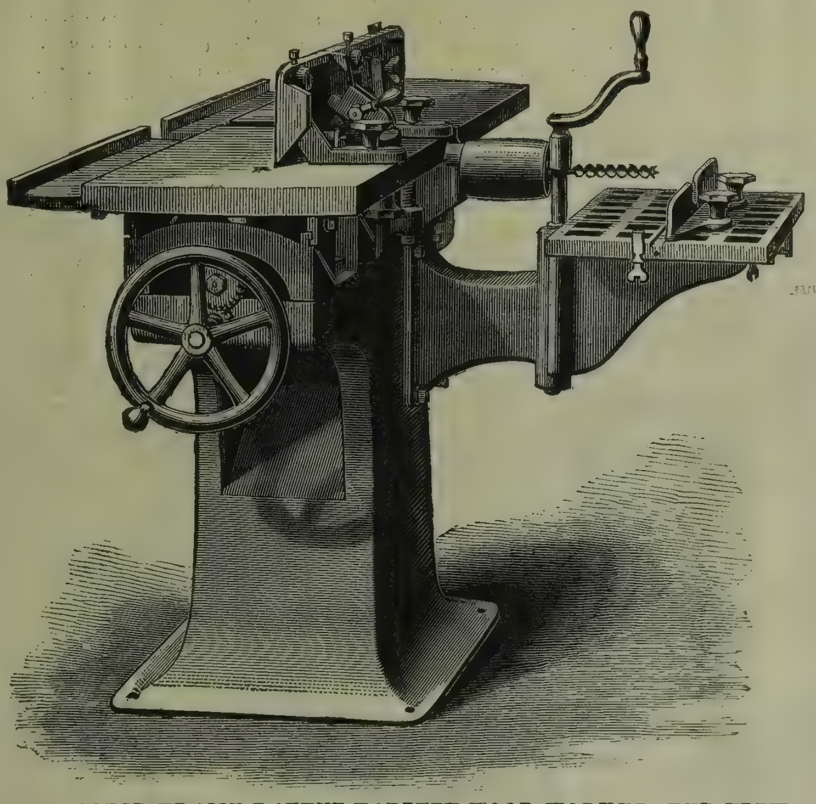
A public building is now in process of erection on the Government Square in Denver, Colo., and is to be one of the finest structures in the West. One wing is designated for the High School, the other for a free public library. There will also be a lecture hall with a seating capacity of 1,000.

Drawings are being prepared for a building for the Milton Building Association, at Milton, Mass., to contain rooms for the use of public library, post-office, bank, and two stores on lower floor, with concert-hall seating 600 on second floor, with Odd Fellows' Hall on third floor. The building will be of brick, about 53 x 120 feet, costing about $25,000. Rotch & Tilden, of Boston, architects.

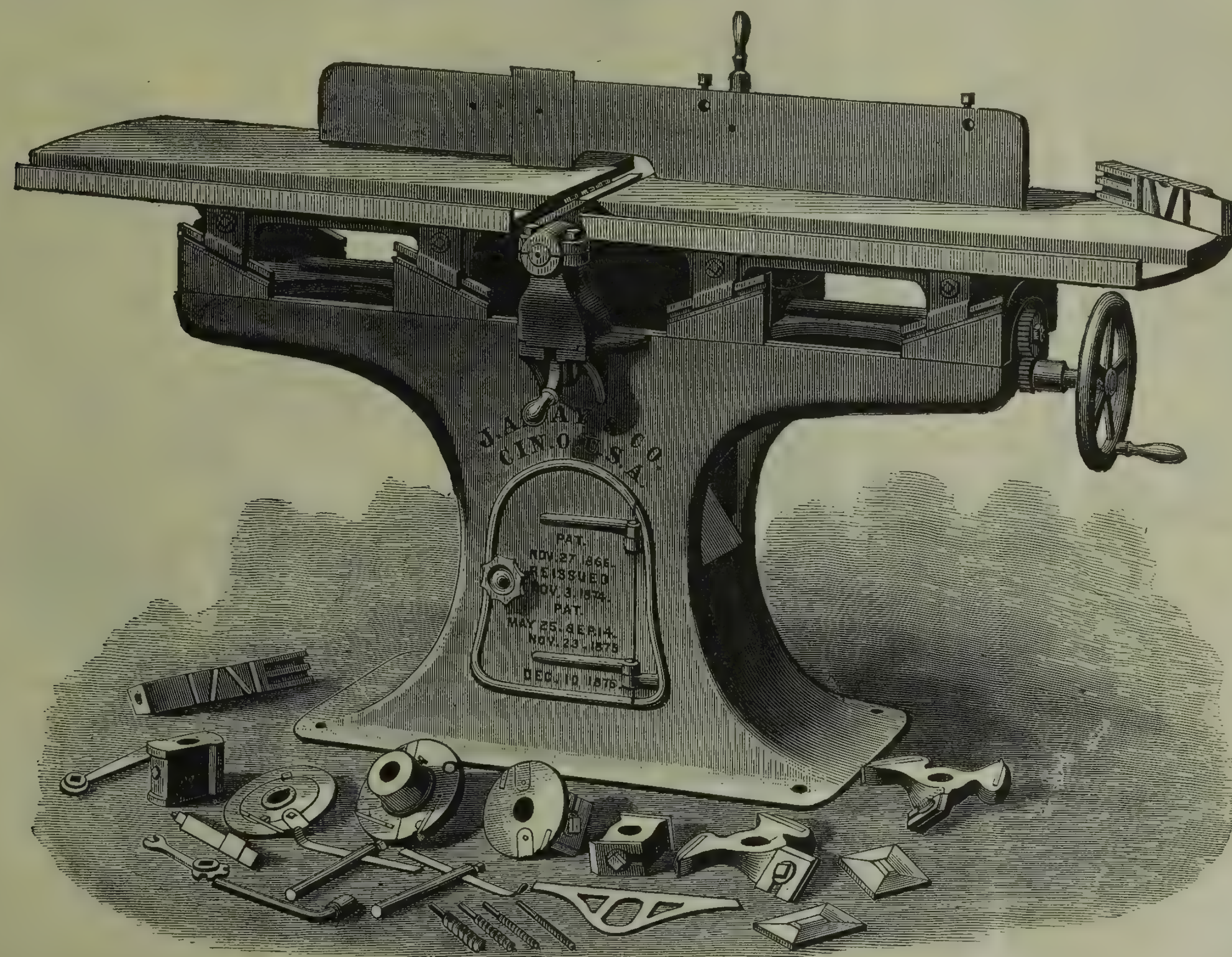
Patent Variety Wood-Worker.

We illustrate herewith another admirable machine from the list of manufactures by the well-known firm of J. A. Fay & Co., of Cincinnati, Ohio, the special features of which will appear from the appended description: This valuable labor-saving machine will be found of great use and benefit to the intelligent operator in almost every wood-working shop for planing out of wind, tapering, rabbeting, jointing, beveling, gaining, chamfering, plowing, making glue joints, squaring up, working beads, circular moldings, etc. It can be belted either from above or below. The arbor is made of steel, of large diameter, running in self-oiling boxes, one of which is detachable, and can be almost instantly removed and replaced for the purpose of substituting different heads for the various kinds of work.

The tables or platens are made of iron, planed perfectly true, have both simultaneous and independent vertical and lateral adjustments, to adapt them to the work being performed, and are so arranged that for facing or planing out of wind these adjustments are made instantaneously, and constantly retain the proper distance between the periphery of cut and edge of table. The operator stands at the working end of the machine, and by means of the hand-wheel and screw is enabled to make almost every manipulation of the tables, singly or conjointly, without changing his position.



No. 2 SOLID FRAME PATENT VARIETY WOOD-WORKER—END VIEW.



No. 2 SOLID FRAME PATENT VARIETY WOOD-WORKER—FRONT VIEW.

When desired, the makers furnish upon the rear side a boring and routing table, same as shown in first engraving, for all common boring and routing. With each machine is furnished one 8-inch three-knife planing, one rabbeting, one jointing, and one capped molding head, also the adjustable fence and bevel rest. The cylinder pulley is $3\frac{1}{2}$ inches in diameter, 5-inch face, and should make 3,600 revolutions per minute. This machine embodies many specially new and important features in this class of wood-working machinery which have been the subject matter of several patents, both in this country and Europe. For further particulars address the patentees and manufacturers, as above.

Castor Oil for Leather.—To preserve leather hose, belting, etc., in good condition, freely apply crude castor oil, warmed if possible. It increases the pliability of the leather and the cling of belts. It does not become rancid, and rats avoid it. In hose it should be pumped in under considerable pressure, thus thoroughly filling the pores.

An Air Engine.

The English journals give an account of an experiment with an air engine at Woolwich, which affords important suggestions to those contemplating subterranean communication in large cities. After the engine had received a charge of 100 cubic feet of air, having a pressure of 1,000 pounds to the square inch, it left the Royal Arsenal station at 12.22 P.M. for a run to and from Dartford, a distance of about 16 miles. Just as the air was admitted to the cylinder, it was heated by a small quantity of steam to increase its energy. The locomotive passed Abbey Wood station at 12.27 P.M., indicating on the pressure gauge 940 pounds; Belvidere station at 12.33, with a pressure of 860 pounds, and Erith station with a pressure of 760 pounds. It arrived at Dartford at 12.50 with a store of energy of 540 pounds pressure. In consequence of waste incurred by shunting, the return journey began with a pressure of about 510 pounds at 1.35 P.M., and Plumstead station was again reached at 2.10. This locomotive, which is not so large as one of our ordinary street cars, and weighs only about 10 tons, can draw a load of 16 tons up a moderate incline. It can be charged with air in 15 minutes. It does not, of course, send out any rush of steam or noxious gases, and all the noise it makes is

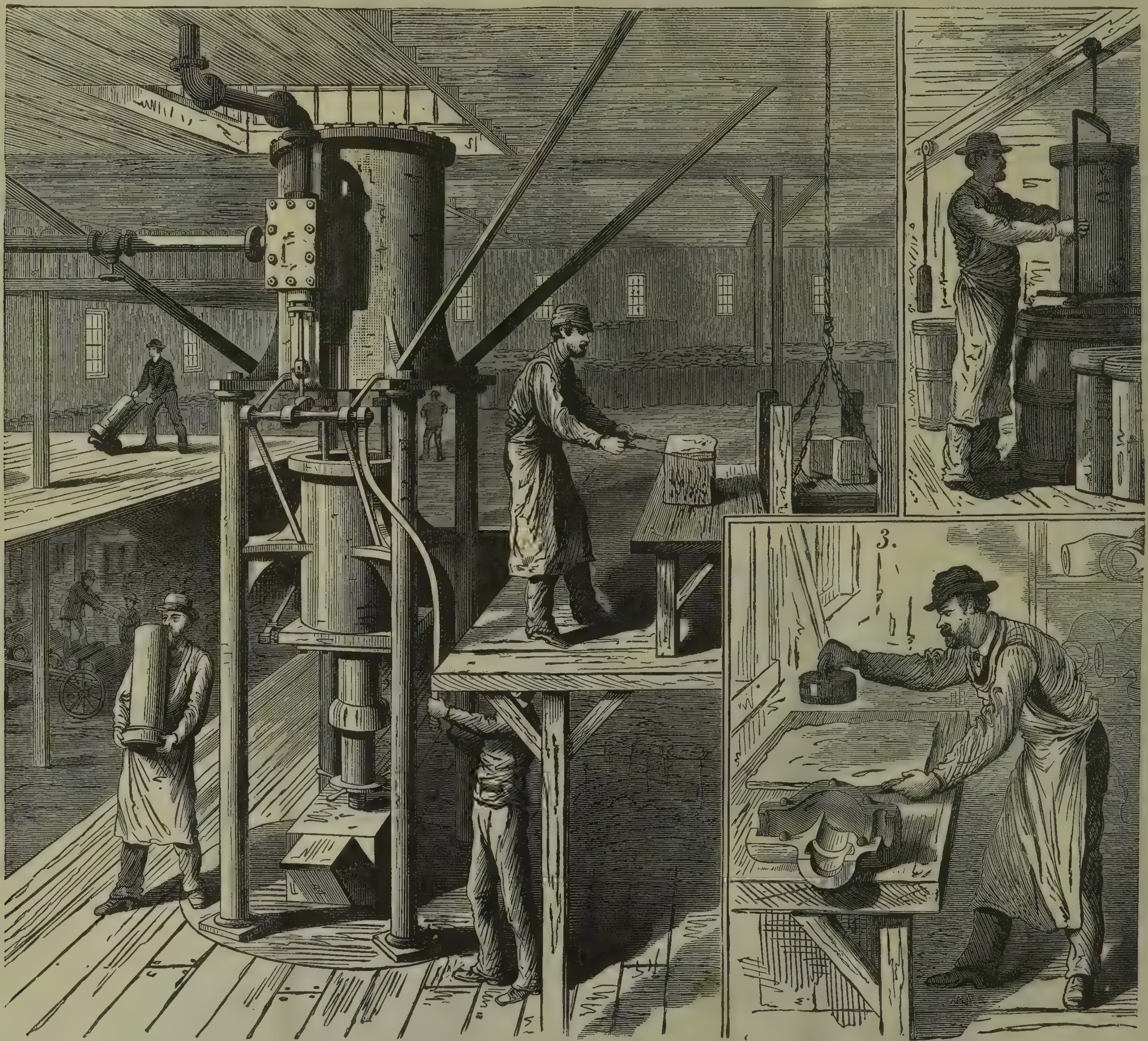
very trifling. It can be used with advantage on surface railroads; but its sanitary advantages for underground traffic are very obvious. This locomotive was designed by Major Beaumont, of the Royal Engineers, and he calculates that if one on the same principle, but of the size of a steam locomotive, weighing 50 tons, were made, it would be the most powerful traction motor in existence.

The Manufacture of Drain Pipes.

The manufacture of drain pipes has been brought to a high state of perfection. It is similar in many respects to that of bricks and tiles, and, as with these, the quality of the product depends not so much upon manipulative skill as upon the proper selection of the materials and their freedom from impurities. The material employed in the manufacture of drain pipes in the neighborhood of this city is a refractory potter's or plastic clay, of which that from Woodbridge, N. J., which is largely used for the purpose, may be taken as a fair representative. This particular clay is an aluminous silicate, containing a slight percentage of lime and magnesia, with more or less oxide of iron. It need hardly be explained that the refractory clays used in this manufacture do not require to be of the finest quality. The latter are reserved for manufacture into fire bricks, crucibles and pots for smelting metals, and for glass-makers, retorts for gas-making and the like. Nevertheless, though a large variety of clays, unsuited for these uses, may be employed advantageously for the production of drain pipes, the material must be sufficiently refractory to permit the articles fashioned from them to be burned hard without softening under the heat, or in any way losing the regularity of their forms or the accuracy of their outlines. If not sufficiently infusible, the pipes will become crooked and flattened in the kiln, and objects of more artistic workmanship will lose their character and their value.

The following description will serve as a fair illustration of the method pursued in manufacturing this class of articles: The first process consists in tempering the clay with water and thoroughly mixing it, which is done in most establishments in pug mills having spirally disposed blades, which cut up the mass and at the same time move it forward. In order that the mixture shall be perfect, in some cases it passes through two mills, one horizontal and the other vertical, from which it goes to the press. Where the presence of stones, nodules of iron pyrites, and similar objectionable foreign substances is suspected, the precaution of wiring is resorted to—that is, a workman takes a good sized lump of the clay and cuts it through repeatedly with a wire.

Iron in the clay is the objectionable substance with which potters of high and low degree must contend, and being one of the commonest of mineral substances, few of the pottery clays are free from it. In the fine kaolin it is disseminated in microscopic specks, and in the coarser drain pipe material, in lumps often as large as an egg. Its presence is very injurious. In fine porcelain it produces dark spots, which at once reduces the quality of the ware; and when in the drain pipe material in considerable quantity, it melts, runs down, and leaves holes. It seems to have been impossible, up to the present time, to devise any mechanical process for removing this injurious substance.



THE MANUFACTURE OF DRAIN PIPE.

After wiring, the stiffly tempered, plastic mass is placed in the press shown in our engraving, which has the following construction: It consists of a receiving cylinder, in which is a follower, driven down by a piston working in the large steam cylinder seen above. Through the lower cylinder runs a spindle, which supports at its lower end a core. At the bottom of the cylinder are adjustable dies, between which and the core the clay is forced, emerging, as in the case of the lead in lead pipe manufacture, in the form of a tube or pipe. Before pressure is applied, however, a wooden drum is placed upon a platform, which may be screwed up and down, and which is located on the bed-block of the press. Sliding on this

drum is a core or mold of the exact shape and size of the inside of the enlargement or collar of the pipe. This mold, when the pressure is first applied, is brought up close under the cylinder, and a pair of collar dies are brought around it. The annular space between these dies and the core is closed beneath, so that when the clay is forced, it cannot descend, but is obliged to fill the annular space first mentioned. When this has taken place, the collar dies are opened and the pressure continued, the result being then the formation of a pipe of uniform diameter, which slides gradually down over the drum, as shown in the illustration. If, however, the pipe is intended to be curved instead of straight, the guide drum below is not used, but as soon as the collar is formed, the attendant workman grasps the pipe as it comes out and bends it to the desired curve by hand. As soon as each section of pipe is thus finished, it is removed and placed upon a rack until thoroughly dry.

Where odd shapes, as traps and the like, are to be made, no press is used, but the plastic material is first hammered into compact condition by hand, and then packed in molds, as seen on the right of our engraving.

Previous to baking in the kilns, the practice of many makers is to dip the pipe into a glazing mixture consisting of a thin fluid mixture of what is known to the trade as slip-glaze, with water. Where salt glazing is used, the material is thrown into kiln at the proper heat. On the subject of glazing, the views of manufacturers are very diverse, and much controversy has arisen respecting the relative merits of the several methods in vogue. Generally speaking, the Western manufacturers use the salt glaze, while those of the Eastern States prefer the "slip" glaze. The material used for the slip glaze is a species of clay, obtained from a locality near Albany, N. Y., and in appearance resembling ordinary potter's clay. It contains an appreciable quantity of carbonate of lime and alkalies, to the presence of which its efficiency in glazing must be ascribed, since at the high heat of the kiln there will be produced, by the action of these alkaline constituents, a decomposition, resulting in the formation of a vitreous double silicate of the lime and alkalies with the alumina of the clay.

The manufacturers of slip-glazed wares claim that the slip glazing is denser and has far better resisting qualities to acids, alkalies and other destructive agents, than the glazing produced by the use of salt; while, on the other hand, the makers of salt-glazed wares as strenuously defend the quality of their products. As it is no part of our purpose to settle these rival claims to excellence, we pass the matter by with the simple mention, and return to our description.

A glance at the upper right hand portion of our engraving shows the method generally adopted for dipping large pipes into the glazing mixture. The pipe rests on a counter-weighted suspended platform, on which it is easily lowered or raised by hand into and out of the mixture. Baking is done in the ordinary way in kilns. No seggars are used, and the pipes are disposed in nests—that is, inside of a 12-inch pipe there is usually placed an 8-inch one, and inside of that again a 4-inch pipe. The heat is usually kept up for from fifty-four to fifty-six hours, when the glazing, having turned to a dark-brownish, glossy hue, the work is done.

Explosion of a Rolling-Mill Boiler.

We continue our contributions to the subject of steam boiler explosions this month, with the publication of an able analysis by the President of the Hartford Steam Boiler Inspection and Insurance Company, of an explosion caused by faulty construction and improper setting. As the defects here exposed are by no means uncommon, the case will be found to present points both interesting and instructive. We give the history of the explosion as it appeared in the company's monthly bulletin.

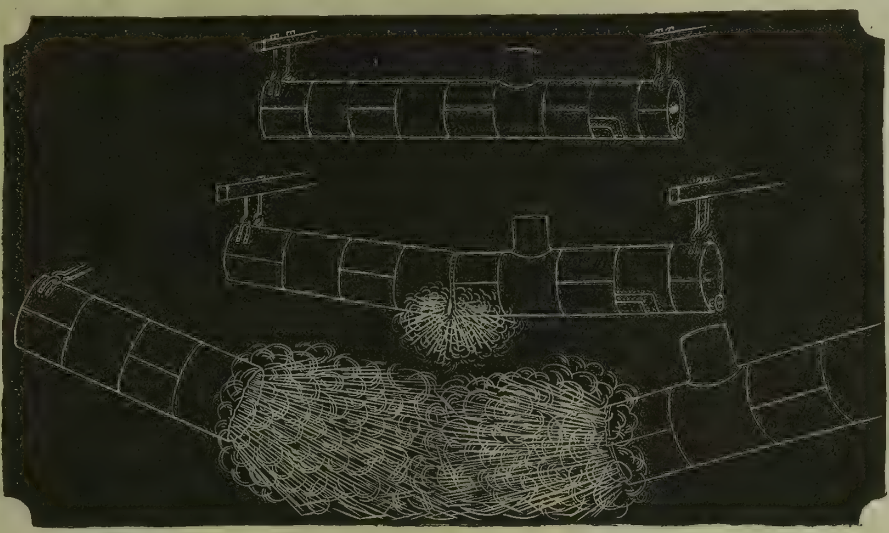


Fig. 1.

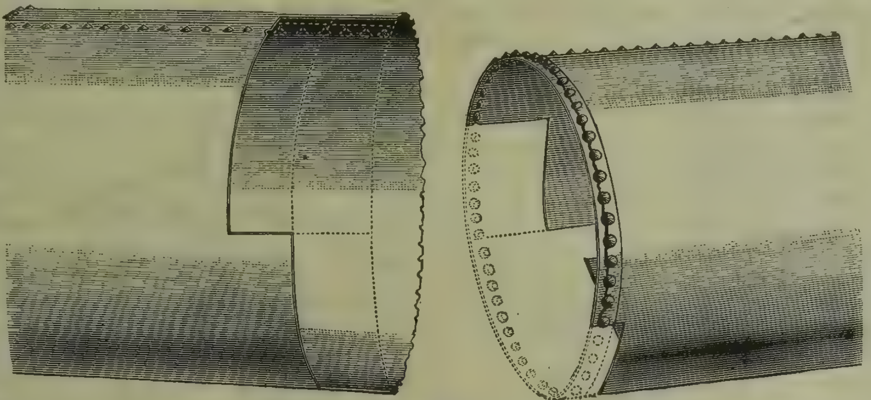


Fig. 2.

"Explosions of boilers at rolling mills and blast furnaces are of frequent occurrence. When we consider their great length, in many cases their defective construction and setting, and the manner in which they are cared for, we confess a feeling of surprise that they do not more frequently explode. Run day and night, 144 hours a week, their bottom sheets exposed to an intense heat, with great variation in their work, due to the manipulation of the iron in the furnaces over which they are placed; also from severe strains caused by the sudden slowing and almost stoppage of the rolls at times by heavy blooms or plates; the engine valves are then wide open, making a sudden draft upon the boilers to keep up the steam supply.

"The boiler here described, known as No. 15 by the mill people, by its explosion caused the death of 13 persons and the injury of several others, with a loss or damage to property of about $3,000, upon which there was no insurance. It was what is known as a plain cylinder, erected about the year 1871, though it has not been in continuous operation since that time. In dimensions it was 27 feet 5 inches long, 36 inches in diameter; shell, $^5/_{16}$-inch iron in nine courses, varying a little in thickness, as they often do; heads of cast iron, the feed-water entering through the front head, the blow-off at the back; steam dome, 25 x 32 inches, with a cast-iron head, upon the top of which was mounted a common lever safety valve of 3 inches diameter, loaded at 65 pounds pressure; under the valve-chamber was a T connection for the steam pipe. The arrangement of steam pipes was that generally used in mills of this kind—a main steam pipe, 8 inches in diameter, leading from the engine through the mill, with 6-inch branches to each boiler; at the places where the branches tapped the main pipe, were stop-valves, by which its boiler might be shut off the line whenever necessary for examination, cleaning, or repairs. When the explosion occurred, carrying away the connecting branch pipe, the steam from all the other boilers emptied upon those who were near it. This explains why nearly all the victims of this explosion died from scalds. The setting was built above the furnace in the ordinary way, to utilize its waste heat, which passed upward through an up-take at one end, turned under the boiler, and thence into the stack, the whole resting upon an iron structure about 10 feet above the ground; the weight of the boiler and connections hung upon four brackets (or lugs), one at each side, at the extreme ends, making a distance between the supports of 25 feet 3 inches; there were no intermediate bearings or supports. The side walls of the setting closed into the boiler along the middle of its depth about 5 inches below the usual water-line; over the boiler-top was a thin covering of some light material, resting on that a single layer of brick on edge. The foregoing, describing the setting, is based upon an examination of the adjacent boilers, which I was assured were similar in all respects to the one destroyed by explosion.

"At the left side of Fig. 3, upon the side and bottom of the boiler, it will be noticed there are three patches, caused by the flame from the up-take impinging upon the sheet immediately over it, driving off the water, overheating and cracking it. This defect was no doubt greatly aggravated by the feed entering the boiler at that point. It was pumped from an open well at a temperature perhaps of 100°. The patrons of the Hartford Steam Boiler Inspection and Insurance Company, using boilers similarly placed, were advised of this danger some years ago. I am speaking more particularly of the up-take now, and have generally protected their boilers as advised by its inspectors, by an arch or hood across the up-take, the effect of which is to protect the exposed part as well as curving the flame along the boiler bottom.

Fig. 3.

"At the coroner's inquest, mention is made of the great difficulty and delays occasioned by seam-leaks at the back end, and at the up-take end of the boilers. Some of their boilers have during the last year been protected by the method just described; No. 15 had been altered in accordance with this plan, at the time a third patch was put on the fire sheet, only five weeks previous.

"Some twenty minutes or more before the explo

sion, a leak was reported upon the bottom of the boiler; it seems to have increased for a few minutes after it was thought sufficiently dangerous to have the charge drawn, and the fire was dropped. When the explosion occurred, the water-tender was at the back watching the leak; he describes it as being it the middle of the boiler, extending about 2 feet around the seam, the point at which separation occurred (see Figs. 1 and 3); the ladder upon which he stood was hurled down and crushed by the fall of the smoke-stack, but he miraculously escaped with some slight bruises and scalds. The rupture, as before stated, occurred at a girth seam, the line of fracture passing through the rivet holes, leaving half of the lap held by its rivets in place, as shown by an enlarged view of the ruptured edges in Fig. 2; the parts of the shell missing at the edges were since cut out for the purpose of subjecting the iron to a test to determine its tensile strength, the result of which has not been made public.

Fig 1

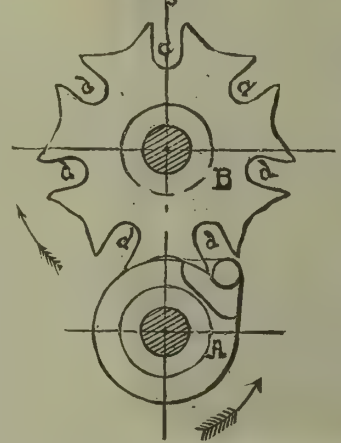


Fig 2

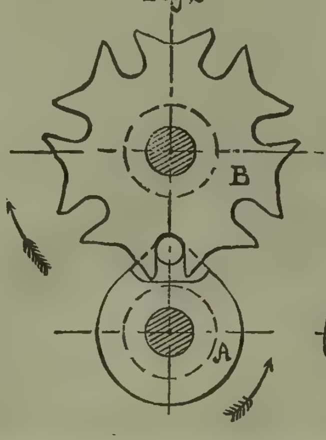
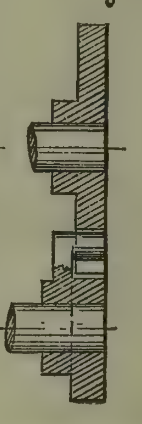


Fig 3



The material of which this boiler was constructed was apparently charcoal iron of average quality, the workmanship bad, and were its builders known (unfortunately they are not), they richly deserve to be indicted and punished. The superintendent testified that their boiler was built for a former management by several makers, and have since been so changed about they cannot be positively traced, and no one has been found who will admit its paternity. An examination of the rivet holes at the point of rupture proves that seven-10ths were not fair holes, and indicated the drift-pin was used to bring them in position, so the rivets could be inserted, thus subjecting the outside lap seam to a far greater strain in forcing it to its place than it ought ever have been subjected to under steam pressure. There is no good reason for believing that seam was any worse than the others uniting the remaining eight rings of plates; the way the rivet heads are flattened down and drawn over provokes a strong suspicion that this is the case.

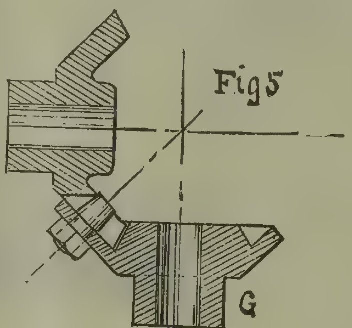
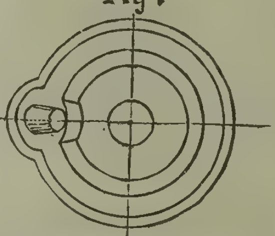


Fig 6

Fig 7



If this seam was no weaker than the others, why should rupture occur there? This is answered by many thoughtful men: Owing to its great length, and having no intermediate support, the weight of the boiler, connections and contents, in the aggregate not less than $5\frac{1}{2}$ (?) tons, would, by alternate expansion and contraction, bring the greater part of that strain upon its middle seams, analogous to a beam supported at its ends and loaded in the middle. If so, the effect seems evident; it is only a question of the strength of the material composing the lap seam. It has been determined, by experiment upon single-riveted lap joints of good material and workmanship, that this is from 56 to 60 per cent of the strength of the plate; but in the ruptured joint we are writing of, one of these conditions is proven not to exist—namely, good workmanship. Who can tell us the strength of a lap joint whose rivet holes have been distended by the drift-pin, as these are believed to have been? Engineers do not agree upon this question of sustaining boilers by center supports, and point to the fact that hundreds of boilers now running, and have seen some of them twenty or more years suspended as this one was, without giving any trouble, when the material and workmanship were what they should be. A careful inspection should discover evidences of the straining of a girth seam before rupture occurs. The punching of the rivet holes is not the only evidence of an utter disregard of all principles of boiler construction by its maker, as is further evidenced by the construction of the steam dome of 25 inches diameter upon a 36-inch shell with a single-riveted lap, *and the shell cut away the full opening of the dome.*

"The effect of the feed-water, which from its source is known to deposit a troublesome lime scale, has not been discussed, because the scale upon this boiler did not much exceed the one-32d of an inch in thickness, and did not in any known way contribute to the explosion. Nor do I think it necessary, for the same reason, to consider the question of over-pressure (of which there was no evidence).

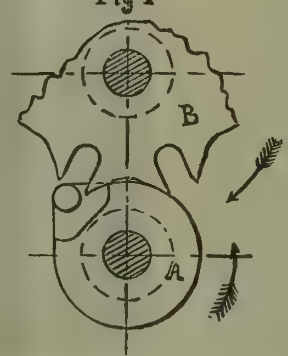
"From the preceding statement of what are believed to be the facts, I draw the following conclusions: That this boiler was so faulty in construction as to greatly lessen the margin of safety (strength) which a new boiler should have; that the inherent weakness of its construction was greatly aggravated by the plan of its setting, and unless sooner discovered, and its defects remedied, its explosion was certain, and dependent only upon the strength of its middle lap seam, and that in my opinion had become so weakened by the strain upon it, that it ruptured at its ordinary working pressure of about 55 pounds steam, the middle part of the boiler dropping when that occurred. The explosion caused by the issuing steam and water projected its two halves in opposite directions, (see A, Fig 1). The fact of so little damage being done to the mill property, may, I think, be attributed to the angle at which the parts of the boiler were projected, which probably did not exceed twenty degrees.

"This explosion conveys its own lesson, which cannot but encourage those who believe in thorough periodical inspections as a preventive of steam boiler explosions, and is deserving the thoughtful consideration of others who have not given that attention to the subject its importance demands. The defects pointed out in this boiler as not of uncommon occurrence, are, in fact, such as appear in every monthly issue of the *Locomotive* under the head of "Inspectors' Reports," but if they are not discovered and the remedy applied, surely end in disaster."

Cooper's Mechanical Movement.

The following correspondence, which will doubtless prove interesting to our mechanical readers, has been somewhat delayed in publication, for the reason that we wished to give Mr. Cooper, whose invention is the subject of criticism, the opportunity of presenting his reply to the points raised by M. E., in the same issue:

Fig 4



Editor M. & B.:

Your favor received. Enclosed I forward you a few sketches showing some of the many ways this movement is applied in loom building. As shown in Fig. 1, it is applied for driving the pattern-chain cylinders for harness and shuttle-box mechanism. Fig. 3 is a sectional view of the same. Figs. 5 and 6 show how it is applied in the same way as bevel gearing, mostly used for drawing pattern-chain cylinders for harness. Fig. 7 is an inside view of pin-wheel G. As shown in Fig. 8, it is applied for shuttle-box mechanism. Fig. 9 is a sectional view of the same. United States patent No. 129,640, of July 16th, 1872, will show you another way of constructing it for the same purpose.

The above mentioned is mostly applied on Crompton looms when purchasers do not order it otherwise. As in Figs. 1 and 5, it is found on woolen as well as on cotton looms (Crompton's); as in Fig. 8 and patent No. 129,640, only on cotton looms (Crompton's). I have seen it on other looms; so far as I remember, on Thomas' and Kenisen's, but not as frequently.

In looking over some old papers, I find the same movement applied by Mr. S. Eccles in shuttle-box mechanism, in 1850 (see U. S. patent No. 7,137, 1850). The pin-wheel he uses has two or more pins instead of one, as used at present. If I would take the trouble to look over old English mechanical works, I am sure it can be found applied for a great many other purposes, but my time will not permit.

As you fail to see that the movement, so far as there is a movement in the "Geneva stop," is the same in character as Mr. Cooper's, I have drawn one as I find it in "Appleton's Cyclopædia of Applied Mechanics," (see Fig. 10 of my sketches). Please examine and compare the movement of it, say for two or three teeth in B, or two or three revolutions of A, with the other movements, as shown in the sketches, and Mr. Cooper's, as shown in the Manufacturer and Builder, and oblige by informing me in what I shall find the difference. I know it is designed, constructed and applied for a different purpose; but that does not change the character of the movement, as far as it is a movement. Let us compare the movement of say two or three teeth in Fig. 10 with the other movements as applied on looms, and Mr. Cooper's as shown in your

journal. A, as I mark the pin-wheel or tooth-wheel in all of them, is all alike in having a cylindrical disk with a tooth or pin *c* projecting beyond the surface of the disk. The teeth $e\ e'\ e^2$ on wheel B have a concave surface corresponding with the disk on A. In B, slots with parallel sides, as per sketch, for pin *c* or tooth *c* to slide in, is made either of blocks or cast in or cut out of the solid disk, a distance apart corresponding with the movement of *c*; A revolves in the direction of the arrow, when *c* enters the slot *d* and touches or comes in contact with tooth *e* on wheel B; B is unlocked and carried forward by *c* until it leaves the slot *d*, or in the position as shown in Fig. 4, when B is again locked, and will remain so until *c* again enters the slot *d′*, comes in contact with tooth *e′*, when it again is unlocked, carried forward, etc., and the same movement repeated.

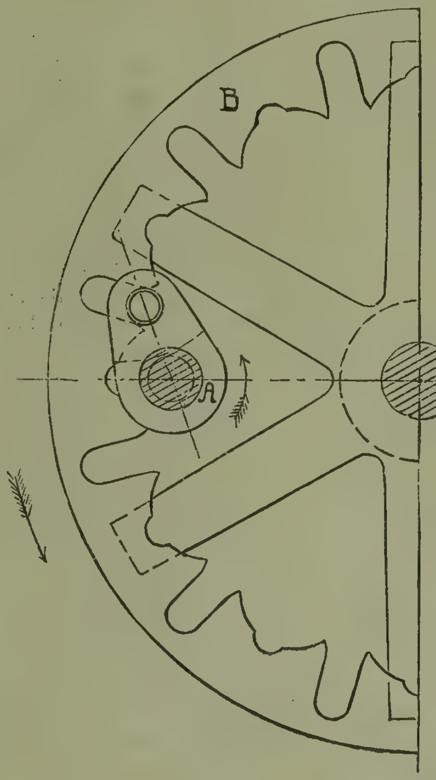


Fig 8

As far as I can see, I cannot make out the slightest difference in the movement in either. Its appearance will change somewhat to suit the different purposes for which it is applied, but its character cannot be changed. A good deal more could be said about this thing, but my time will not permit at present. If I can furnish you with more information, write me and I will be pleased to give all I can.

Yours truly, M. E.
Worcester, Mass.

The following is Mr. Cooper's reply:

Editor M. & B.:

The different forms of intermittent movements submitted by M. E. are very interesting to see and study, and in so far as *movement* is concerned, or "character," as M. E. says, those given by him, and mine, are the same. It is true, they all have one continuously revolving piece, except the "Geneva stop," and one piece, actuated by the first, having an intermittent revolving movement. So far they are alike—mine as well as those submitted by M. E. But even with this similarity, there are points in mine which M. E.'s pictured movements do not possess, and I am confident that none of his solve the problem which I sought to solve, and which my movement does effectually dispose of—and that is, *precision of movement and holding with facility of adjustment to wear*, and these are the very features which my claims embrace, and they are those which constitute the real difference of the several mechanisms referred to.

All the "movements" submitted by M. E. are made by solid pins working in unalterable slots, and all the holdings are made by fixed hubs turning in unadjustable cavities, so that in little time after use precision of movement must be lost in wear of the working parts; and for this reason it is said in the description of my invention, in the Manufacturer and Builder: "It is of the greatest importance that the disk should be immovably locked and in the proper position during the falling of the plunger, so that the latter may coincide with the chamber which it has to enter; it is also important that, as the plunger is elevated free from the chamber, the disk should be promptly and accurately moved to the desired extent for bringing another chamber *directly* beneath the plunger. It will be evident that the mechanical movements embodied in this invention will meet all these requirements."

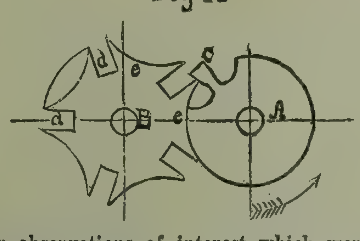
The reader now should have no difficulty in seeing the difference between the result gained by my invention and that by the "loom" movements. These latter will answer if the motion be intermittent merely, without great exactness at the stopping places; but the result which I sought to gain must of necessity be unchangeably precise at the stopping places, in order that the plunger may fairly enter each and every die-box; and this is the essential feature of my invention.

J. H. Cooper.

Peculiar Industries.

Among the many peculiar industries ferreted out by the special agents of the Census Bureau, one of the most curious is reported to have been discovered in Boston, where a firm is reported to be doing a large business in making an imitation honey in the comb. Singular as this statement appears, there seems to be no reason to doubt it. According to the account given by the special agent to whose knowledge the case was brought, the comb is molded out of paraffin wax, in good imitation of the work of bees; the cells are then filled with simple glucose syrup, flavored doubtless with some genuine honey, and sealed up by passing a hot iron over them. The product is sold for the best clover honey, and much of it is said to be shipped to Europe.

Fig 10



Other observations of interest which were made, were that the confectioners, besides using glucose very largely as a substitute for cane sugar, likewise employed immense quantities of white earth (*terra alba*). It is practically harmless, and being very cheap, is used by the trade to make weight and bulk.

Great quantities of tomato catsup, it has been ascertained, are made without outlay for the raw material, the ingenious manufacturers gathering the skins and refuse of the great tomato canning establishments.

Another industry, the magnitude of which would certainly not be suspected, is the manufacture of paper patterns for dresses and wearing apparel. In New York alone, there are reported to be no less than ten such establishments, which consume many tons of paper and dispose of many thousands of dollars' worth of such goods all over the country.

The manufacture of artificial flowers and feathers is reported to be a rapidly growing industry.

The work of the Census Bureau seems to have been planned in a far more extensive and systematic manner this time than on previous occasions, and the results when published promise to be of the utmost value.

Improvement in Punching Iron Plates.

At a recent meeting of the Polytechnic Association of the American Institute, the subject of punching iron plates and the construction of boilers was taken up for general discussion. Mr. Samuel H. Jenkins, of New York, read a paper upon a new form of punch which he had invented, and the results which were obtained by its use. The ordinary punch, in making a ¾-inch hole, leaves it ⅞ of an inch at the bottom in ordinary boiler plate. The effects of this were graphically illustrated upon the blackboard by drawings of fair, good and bad boiler work. It is, of course, always desirable to put the small ends of all punched holes together, but even with the most careful management it is found that only about one-third of a boiler can be made by turning the sheets over so as to accomplish this. The attempt to force rivets to fit tapered holes results in weakness of the work. "I venture to say," said Mr. Jenkins, "that fully 75 per cent of all our boiler explosions, as well as the breaking in two of many iron ships, may be traced as a result of this kind of construction. In proof of this, I will pass around some samples of rivets taken from what our English cousins claim to be a piece of first-class workmanship—the steamship *Anchoria*, of the Anchor line. While she was on the dry dock for repairs after her collision with the *Queen*, I visited her and obtained these rivets."

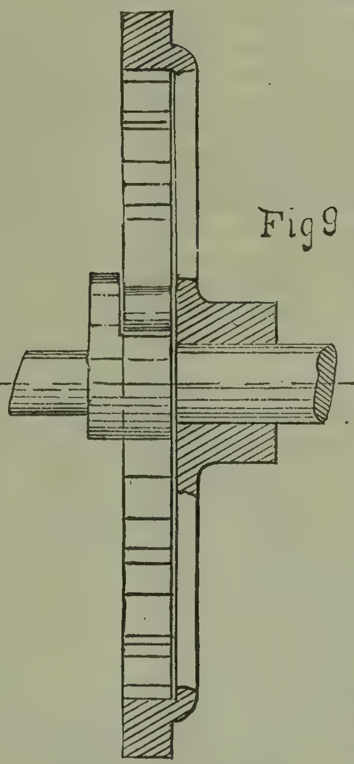


Fig 9

The speaker then showed a large number of rivets, which were in every case badly crippled by having been driven in holes which did not match, and which had been partially forced into line by the drift-pin. The tapering form of hole in several cases apparently aggravated the evil of bad spacing.

The new style of punch which was shown was intended to give a clean, parallel-sided hole in an ordinary punching press, by means of a punch. The new tool consists of a punch, which, for ordinary boiler-work, is ⅛ inch smaller than the finished hole is to be. A short distance from the face of the punch there is a projection, or what may be described as a cutting shoulder, which reams or shears the hole out to the finished size. The face, or cutting edge, of this portion of the punch has a wavy profile. It is depressed on opposite sides of the punch, and raised above a horizontal line between these depressions. In this way it begins its cut on opposite sides, and by the time that the punch is through the plate, the gullets of the upper part are just beginning to cut. The hole made is very close to size, smooth, and does not buckle or spring the plate. If the ordinary punch is made to fit closely and punch a smooth and tolerably cylindrical hole, the plate is so sprung as to require a great deal of hammer-work to make it true.

With holes made by the new punch, test samples have shown considerably greater strength than either

punched or drilled holes. The speaker then stated that the only reason he could see for the superiority over drilled work, was the fact that the punch left the iron in a more compact state about the holes. The following are the figures: Strain required to shear sample with old-style punched holes, 38,820 pounds; sample with drilled holes, 39,210 pounds; sample with holes punched by the new punch, 39,850 pounds. Each sample was riveted on a machine, and each was supposed to be good work of its class.

Scientific.

Making Plaster Casts Impervious to Water.—Some time ago the Prussian Minister of Commerce and Industry offered a prize for the best method of treating plaster casts so as to render them impervious to the action of water. It is well known that at present plaster casts, when exposed to the action of the atmosphere, speedily lose their sharpness of outline by the solvent action of rain water, besides in a short time becoming soiled by the lodgement of dust in the pores of the plaster. For these reasons, this material, otherwise excellently adapted for the multiplication of the costliest and most finished artistic objects, is quite unfitted for exposure to the atmosphere in the parks, gardens and public places where it would be exposed to the action of the weather.

The object of the offer of the Prussian Minister above alluded to, was to obtain a process that would do away with these objectionable qualities, that at present limit the utility of plaster, and to develop if possible a procedure or method of treatment which would render objects of plaster practically independent of atmospheric influences of deterioration. This desirable object, it appears, has been attained by Dr. Reissig, to whom the prize offered by the above named official was lately awarded.

Dr. Reissig's procedure has for its object the twofold purpose of providing a surface upon the plaster which should not wash away, and which at the same time should prevent the entrance of dust, so that the objects could be readily cleaned from time to time by washing. He proposed two methods by which these objects may be accomplished: First, by converting the plaster surface into sulphate of baryta and carbonate of lime by treatment with baryta water; or, second, by converting it into silicate of lime by treatment with silicate of soda or potassa. The first process is described as being the simpler and cheaper one. It depends on the fact that plaster of Paris, a hydrous sulphate of lime, is converted by the action of baryta water into the sulphate of baryta—a totally insoluble substance—and caustic lime, which last is speedily changed, by contact with the air, into carbonate of lime.

In carrying out the process, the author recommends the immersion of the plaster object, which should be quite clean, in a tolerably concentrated bath of baryta water, in which they should be permitted to remain for from one to ten days, according to the thickness of the water-proofed surface that it is desired to obtain. After removal, washing off with lime water, and wiping off with white cotton or linen rags, the objects are to be left to dry. They are then thoroughly water-proofed. They are still, however, porous, and therefore liable to speedy deterioration on exposure from the lodgement and absorption of dust, etc. To remedy this, Dr. Reissig coats the water-proofed articles with an alcoholic soap solution. This penetrates readily into the pores of the plaster, and the evaporation of the alcohol leaves behind a layer of soap which fills up the pores, and when washed, the soap is converted to suds, with which the dust is readily washed off.

Utilization of Waste Products.—The glycerine industry, which has attained to large proportions, is a remarkable illustration of a great industry based entirely upon what was, until lately, a waste product of the soap-boiler. As even more important in this category, we may name the industries connected with the manufacture of aniline dies and artificial madder from the refuse of coal tar, that was once the abomination and nuisance of the gas works. Old boots and shoes, and leather waste generally, are now turned to good account by the chemical manufacturer in producing the cyanides, ferro and ferrid-cyanides, that have become indispensable in color printing and in photography. Of the carcasses of slaughtered animals not a scrap or morsal is allowed to go to waste; and even the waste blood of the abattoir is utilized by the sugar refiners and the manufacturers of albumen.

Sawdust, mixed with blood or other agglutinative substances, and compressed by powerful pressure in heated dies, is formed into door knobs, hardware and furniture trimmings, buttons, and many other useful and decorative articles. The spent tan-bark of the tanneries is utilized as fuel under steam boilers. Oyster shells are burned to lime; the waste of linseed oil factories is largely sought after as food for cattle; the waste ashes of wood fires are leached for alkali; river mud, mixed with chalk, is ground and burned to make the famous Portland cement; the waste gases of the blast furnace are utilized to heat the blast, and to generate the steam that drives the engine that furnishes the blast; and the slag of the iron furnaces that from time immemorial only served to decorate the hillsides, is now cast into building blocks, granulated to make building sand, made into cement, mixed with suitable chemicals and made into the commoner grades of glass, or blown by steam jets into the finest filaments to make the curious mineral wool for covering boilers, steam pipes, etc. The waste heat of the lime kiln, in England, is made to generate steam and to heat large buildings. The great hills of coal dust in the anthracite regions of Pennsylvania, which have for years borne silent but eloquent testimony of the crudity and wastefulness of our methods of mining coal, will doubtless gradually disappear beneath boilers supplied with ingenious dust-burning devices, or in the form of lumps of artificial coal will be utilized in our kitchens and parlors. Even the anthracite deposits themselves, now so enormously valuable, were but a few years ago so many layers of black stone, unappreciated and valueless. And so the record might be indefinitely extended, showing how modern science with the most beneficent results is steadily teaching the world to utilize the waste substances of nature and the arts, enabling us to reap advantages where none were supposed to exist, or where, if they were suspected, they were undervalued or neglected.

Wastefulness in the Use of Steam.—As scientific investigation has established the fact that the best forms of modern steam engines only develop a fraction of the power which should be obtained from the combustion of the fuel consumed in the boiler, it will be instructive to ascertain the nature of these losses, in order if possible to apply a remedy.

In tracing out the causes of the loss of power in the steam engine, the first and greatest element doubtless resides in the difficulty—we may be justified perhaps in saying the impossibility—of burning solid fuel economically in any form of furnace that has yet been devised, and for the following reasons: The buyer of coal purchases, at the outset, at least 10 to 15 per cent of non-combustible and useless material in the form of ash, which should of course be deducted from the weight of the fuel to get at the quantity of available combustible. Starting with this quantity, probably not less than 5 per cent of useful combustible is lost by falling through the grate bars in the form of dust or partially burned fragments that find their way into the ash-pit unutilized. Again, in no form of furnace that has yet been devised, has it been found possible to retain the gaseous products of combustion generated in the furnace, long enough in contact with the steam generating surfaces to yield up all their available heat; on the contrary, they are thrown out of the chimney frequently at a temperature as high as 800°. Again, combustion is frequently so imperfect, that great quantities of unconsumed carbon are carried off out at the chimney, with the furnace gases, in the form of smoke, unutilized, and representing a sad waste of heating power. Another item of loss is found in the cold air with which the furnace is fed, and which must be highly heated before it will begin to combine with the combustible elements of the fuel, and which must necessarily abstract this heat from the glowing coals through which it passes; and this item of loss is often a serious one where there is careless stoking and the furnace doors are frequently opened, permitting great volumes of cold air to rush into the fire space. Again, we must take into consideration a variable and often considerable percentage of loss of heating effect due to the radiation and conduction of heat from the generator to surrounding bodies. And finally, we must take into consideration the loss involved in the passage of steam from the boiler to and through the engine.

Summing up all the items of loss in the steam generator, it is probable that with the best boiler which it has been possible to construct, not more than 50 per cent of the thermal effect of the fuel is utilized in the generation of steam, and of this 50 per cent from 15 to 30 per cent is lost somewhere during the passage of the steam from the boiler to and through the engine, by condensation in steam pipes, friction of the moving parts of the engine, and so forth, leaving us but 25 to 30 per cent of the duty actually realized, that theory demands we should have.

It seems somewhat absurd in the face of these facts to see and hear statements to the effect that the possibilities of improvement in the duty of the steam engine have been exhausted. Our inventors need not puzzle their brains concerning new motors so long as they have a margin of 75 per cent before them for improving the steam engine.

Loss in Mining Anthracite Coal.—Mr. P. W. Shaefer, a high authority, in discussing the wastefulness of the present methods of mining and marketing anthracite coal, draws an alarming picture of the state of affairs, when it is remembered that the extent of our anthracite deposits is very limited, and that in consequence of the constantly increasing difficulty of mining it, it must steadily increase in cost as exhaustion progresses. He estimates that not more than 66 per cent of the coal is ever taken out of the mines. That which is brought to the surface is run through a huge structure from 80 to 100 feet high—very appropriately called a "breaker"—ingeniously contrived for the destruction of coal. Of these, there are no less than 300 in the anthracite region. To the top of these the coal is raised, and then descends through a succession of rolls and screens, emerging at the bottom in a series of assorted sizes, from huge blocks of lump coal to unmerchantable dust, which last forms a grievously large proportion of the whole. This process involves, according to Mr. Shaefer, a loss of good coal equal to 20 or 25 per cent of the whole quantity mined. The coal wasted in mining, say 40 per cent, and in preparing, 25 per cent, brings up the total of loss to the alarming figure of 65 per cent.

Paper from the Waste Pulp of Glucose Factories.—An intelligent correspondent, Mr. H. Studneczka, Superintendent of the Leavenworth Sugar Co., of Leavenworth, Kan., has called our attention to the possibility of utilizing the immense quantities of pulp remaining from the corn after the extraction of the starch. This pulp, which is at present a waste product, consists almost wholly of cellulose, or woody fiber, and in the opinion of Mr. Studeczka would be found to be an excellent material from which to manufacture the commoner grades of paper, suitable for wrapping and newspaper purposes. He points out that in India very fine paper is manufactured from the refuse of the sugar cane, which is similar in its character to corn pulp.

In view of these suggestions, it may prove to be of special interest to paper manufacturers to turn their attention to experimenting upon the adaptability of this at present useless product, to serve as a new raw

material in the manufacture of paper; and if the opinion of Mr. Studneczka is found to be verified, the result would be the establishment of a new industry equally important to the manufacturers of paper and of glucose. The immense and constantly growing proportions of the glucose manufacture would afford the assurance of an abundant supply of the material should its adaptability for the purposes of the paper-maker once be demonstrated. We esteem this subject to be worthy the special attention of the manufacturers of paper.

Beegerite, a New Mineral.—Prof. George A. Koenig describes, under this name, a new metallic mineral occurring at the Baltic lode of the Geneva Mining Co., in Park county, Colorado. It is a sulphide of lead, copper and bismuth, having the composition $(Pb\,Cu)_6\,Bi_2S_9$, and is therefore related to the minerals cosalite and schirmerite described by Dr. F. A. Genth from American localities.

The following characteristics describe the new mineral, beegerite. The mineral occurs massive and crystalline; in the former condition it is light gray, and in the latter dark gray in color, and with strong metallic luster. The crystallization is isometric, with orthorhombic habitus. The crystals are mostly small, but as one was large enough to be measured, the cosmetric symmetry was fully established. The prevailing combination appears to be the cube with octohedron; cleavage cubical, eminent; specific gravity = 7.273. Dissolves slowly in cold concentrated hydrochloric acid, but rapidly when heated.

The same author describes a new locality for jarosite, in Chaffee county, Colorado, and states as the result of his investigation that this mineral is identical with alunite, the two being identical in form and structure, and forming in fact one species in which Al^2 and Fe^2 may enter singly or in any proportion, replacing each other.

Economy of the Electric Light.—It is claimed by the makers of the latest improved Brush electric light, which, as our readers will remember, employs the voltaic arc principle, that they have been able to maintain 40 lamps, of 2,000 candle-power each, with the expenditure of 34 horse-power. This would be equivalent to the development of a light of 2,353 candle-power per horse-power; and as the average performance of the voltaic arc systems up to the present will fairly be represented by 1,000 candle-power per horse-power, it indicates a decided advance in the efficiency and economy of this system of electric lighting.

When it is remembered, also, that the most enthusiastic supporters of the incandescent systems (for domestic lighting) have only claimed to realize at the best from 200 to 250 candles per horse-power, it will appear that the attempt to subdivide the electric light, which becomes necessary to adapt it for domestic lighting purposes, is attended with an enormous loss of power.

Paraffin as a Preservative of Wood has lately been highly recommended, especially with the view of preserving it against the destructive influences of dampness, acids and alkalies. For this purpose, it is suggested to immerse the well-dried wood in a solution of the paraffin in petroleum ether (benzine) or carbon disulphide. The wood absorbs a large quantity of the material, and the evaporation of the solvent leaves the paraffin behind in the pores of the wood. In employing this recipe, care should be taken to guard against the possibility of the ignition or explosion of the materials.

Red Snow.

On the 25th of last April there fell in the French departments, Basses-Alps and Isere, an abundant snow strongly tinged with red dust. The red matter was so abundant that from Barcelonette all the mountains looked ochery up to 2,800 to 3,000 meters. Above this the snow remained quite white. A notary of the place had a quantity of the snow collected, and, after fusion and filtration, sent some of the dust to M. Daubree, who found in it a large proportion of carbonate of lime, also mica and two felspars, one of them being orthoclase. The powder, then, had probably a terrestrial and not a cosmic origin; but it appears not to be volcanic, like the ash which has sometimes fallen in Scandinavia after Icelandic eruptions. It also differs from the sand of the Sahara, often carried great distances by winds. The point whence it came is still uncertain, but it is interesting to note that the same kind of substance had fallen in 1846, precisely in the same departments, and in 1863 in the Eastern Pyrenees. Showers of similar dust seem to have fallen in Saone-at-Loire on the 15th of April, and in certain parts of Algeria on the 24th.

Railroad Construction in 1880.

The figures of railroad mileage constructed in the United States during the past year afford some interesting comparisons. On the authority of the *Railroad Gazette*, the number of miles of new railroad completed in the United States in each of the last nine years, is as follows:

Year.	Miles.
1872	7,340
1873	3,883
1874	2,025
1875	1,561
1876	2,460
1877	2,301
1878	2,916
1879	4,570
1880	7,150

Distributing the new mileage on the two sides of the Mississippi River, we will have, according to the same authority, the following tabulation:

	East of Miss.	Per cent.	West of Miss.	Per cent.	Total.
1872	4,353	59.3	2,987	40.7	7,340
1873	1,527	39.3	2,356	60.7	3,883
1874	1,487	73.5	538	26.5	2,025
1875	949	60.8	612	39.2	1,561
1876	1,156	47.0	1,304	53.0	2,460
1877	1,114	48.4	1,187	51.6	2,301
1878	1,178	40.4	1,738	59.6	2,916
1879	1,285	28.1	3,285	71.9	4,570
1880	1,452	20.4	5,698	79.6	7,150

From this table it will appear that during the past two years, and especially during 1880, the increase in new railroad construction has been almost wholly in the States and Territories west of the Mississippi. Further, of the 7,150 miles constructed in 1880, 1,453 miles were of narrow gauge (chiefly 3 feet gauge). The total figures of new mileage constructed for 1880 came within 190 miles of equaling the unparalleled figures of 1872, and tell better than anything else the story of the thorough restoration of business confidence throughout the country.

The Hudson River Tunnel.

Work on the Hudson River tunnel is progressing satisfactorily, although the rate of advance is not maintained steadily at its maximum. Some minor improvements have, however, been made recently in order to cheapen and facilitate the work. Formerly the silt dug out was mixed with water in the immediate vicinity of the heading, and was blown out from that point. Now it is conveyed to a sort of sump, near the air-lock, and is blown out there. In order to bring it to this station, it is loaded in a car at the face, from which it is hauled by means of a wire rope wound on a drum, operated by a small vertical steam engine which exhausts into the open air. The car is dumped automatically, the rear wheels, which have a wider face than the front wheels, running up an inclined track. For transporting brick, cement, timber and other materials, a second track is laid in the south tunnel, the only one in which work is now being carried on. We may add that it is now finished for about 325 feet from the shaft.

Cornice Machine Litigation.

The following communication from Mr. George Hayes will be read with interest, as supplementary to his letter published in our March number, relative to the controversy between Mr. Fischer and himself, and which has awakened very general interest:

To the Editor of the Manufacturer and Builder:

In accordance with your request, and very many others, I with pleasure submit further information touching the controversy between Mr. Fischer and myself. I desire at the outset to thank the many gentlemen who have become interested in this controversy, which involves a principle of vast importance to the manufacturing community generally. I sincerely trust and hope that my efforts in this direction will not be misunderstood or regarded in any sense as pugnacious. I am only fighting for justice, defending myself against heavy pecuniary damages, and endeavoring to set right a wrong, that, if passed over, would promulgate a very serious precedent. I feel sure that if I succeed, and if it is shown that Mr. Fischer is wrong in claiming that which belongs justly to the public, my endeavors will be appreciated, not only by the general public, but by the court, for correcting its error. This will contribute much towards consolement for what I have suffered, and which can never be restored—namely, the indignities, the many sleepless nights, the worry and anxiety, and the many unpleasantnesses I have endured under and by reason of this terrible suit.

The proceedings in this case have been conducted in a most high-handed manner, unprecedented in the history of equity practice, and it may here be said, and will be appreciated by those familiar with the mode of procedure in patent or equity causes, that the judge knows only that which is put before him on paper; he does not see the witnesses, he cannot know who they are, and many points and just impressions are lost to him in consequence. For instance, a witness, from his manner, may be seen to be lying or prevaricating; he may be a man whose face and bearing are a true index to his inner soul, and that a bad one, but his name is John Smith, and John Smith is as good a man on paper as John Brown. Judges, from practice and experience, are good readers of the human mind from exterior and personal actions and bearings, and a judge whose mind is so engrossed with the burden of multitudinous cases, should have every facility for obtaining a correct knowledge of not only the testimony of witnesses, but their manner and bearing while delivering the same.

Before entering upon a *resumé* of this extraordinary case, let me again impress upon the minds of your readers the fact that the machine takes no part of the contention. The machine of the Fischer patent is totally different from any of those of the defendant, and there is no evidence on the part of Fischer in the proceedings upon which the decrees of the court have been obtained, that any person had infringed any other claims than those referred to, being the second and fourth, and these are the claims that are held good and valid, no matter what may be the form or construction or mode of operation of any machine, whether it has a reciprocating carriage, or drop, or lever motion, or any organization of any kind whatever. The specification as to these two claims, reads: "The standard of the male die is made concave on one side, to allow the forming of three sides of a square by the apparatus. The male, or stationary die, is underneath the female, or movable die, for the purpose of preventing the latter from being clogged or made imperfect by dirt or other foreign matter;" and the claims read: "Second, the standard D, when provided with one concave side, as shown." "Fourth, arranging the female die G above the male die E or F, for the purpose of keeping the female die clear, as set forth." Notwithstanding the above facts, Fischer now seeks, by virtue of his decree, to control and recover damages upon all machines, as claimed by him, notwithstanding the alleged use is for a purpose entirely different from that contemplated

by Mr. Fischer, so far as I am concerned. That is to say, for instance, a patentee of a hand to a clock, without any other claim on clocks, upon a decree sustaining his patent hand, seeks to recover damages, not upon the hand alone, but upon the entire clock—that is, upon all clocks made and sold having this patent hand in use thereon.

The machine, as used by myself and other defend-

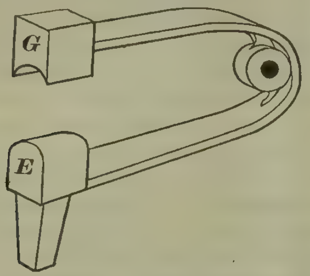


Fig. 1.—The Holliper, Presumably the Invention of Tubal Cain.

ants, performs many other offices besides making a simple angular bend, with a female die over a male die, and since the preliminary injunctions have been issued, that device is entirely cast aside, the dies being reversed, and nobody feels any disadvantage, and further controversy, regardless of the injunction, is thus set aside, and the continuous use of the machine exists the same as it ever did.

The foundation of the alleged great improvement of Mr. Fischer lies first in the old and well-known blacksmith's swage, in which for ages it has been customary to use the "male above female," or "female above male," according to the exigencies of the occasion. The arranging of these devices in a machine in such a manner that the "female" is above the "male" is the exact subject of the fourth claim of the patent in dispute, and the curves at the end of the anvil over which the swedges are placed, constitute the subject matter of the second claim. These two devices I now connect with organized machinery in pursuing the state of the art, as follows:

Fig. 1 shows one of the many forms of using the swage, and is used "female above male" and "male above female," according to the requirements of the mechanic. In endeavoring to find hollipers which had a record of 1866, or two years prior to the "invention of Mr. Fischer," I ran risks of my life. I went one day into the workshop of a musical instrument manufacturer, and there caught this man in the very act of getting his living by using this device. I hailed him. "Stop," says I; "knowest thou not that thou art doing wrong? Thou art infringing a patent." With uplifted hand, in which was a hammer, he was about to

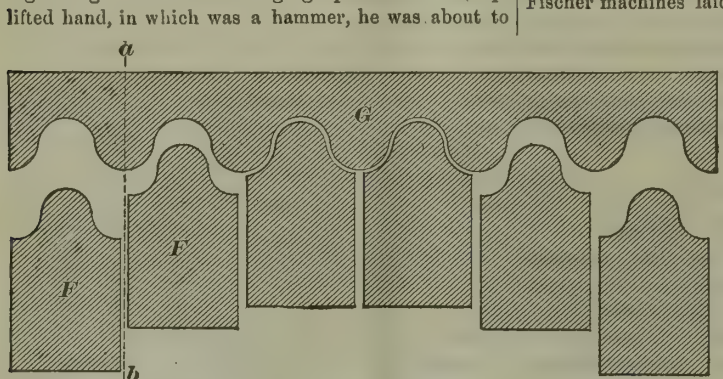


Fig. 3.—The Dies as Used in the Machines Built by Morton, Poole & Co., in 1851.

strike me to the earth, exclaiming: "Patent be d—d!" After some persuasion, and with difficulty, I appeased him by saying that I was not the fortunate inventor and owner thereof, but that, like him, I was a culprit. This device, together with the various forms in which this tool or machine is used, was spoken of by our expert, Mr. Renwick, who says: "An example is spoken of and may be seen in pages 186 and 187 of 'The Practical Metal-Worker's Assistant,' by Oliver Byrne, published in 1851. (This book was put in evidence). This description was originally published in Holtzopffell, and I know it as early as 1848; and in such machines a mere change of location of the dies would bring the male die below the female." Every mechanic knows that they never confine themselves to any location—they merely suited their convenience.

Fig. 2 represents the device that was not discovered during the taking of the proofs, consequently it was not put in evidence. It would not, however, have availed as a defense, notwithstanding "the male or stationary die is underneath the female or movable die, for the purpose of preventing the latter from being clogged or made imperfect by dirt or other foreign matter," as this feature occurs as shown in Fig. 9 of this article, and which was disposed of by his honor Judge Blatchford in Fischer *vs.* Wilson *et al.*, the court ruling that the shoulders *c c* impart to it a different feature. Hence these inventors and patentees, who, no doubt, have passed to their long homes a half century or more ago, if living to-day, could not use their invention, were they to divest the male die of the shoulders *c c*, without infringing the patent of Fischer.

Fig. 3 illustrates the arrangement of dies in the machines built by Morton, Poole & Co. in 1851, and which have been in constant and public use since that date. The female dies are in a gang, evidently self-cleaning, while the lower or male dies are separably movable,

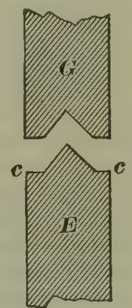
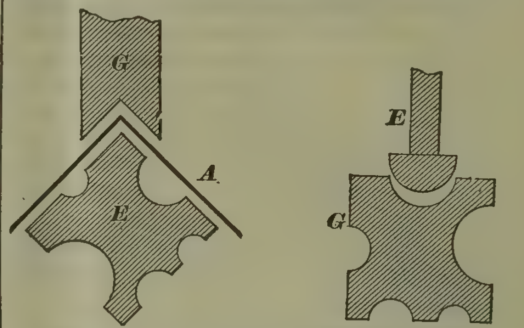


Fig. 2.—U. S. Patent of Richard Wheatly and J. Beaumont, Nov. 4, 1807.

and are operated by being thrust upward by cams placed underneath and upon a shaft, the center two coming up first, and the four outer ones separately; these dies are placed one-eighth of an inch apart, in order that in corrugating black iron the scale may pass between the two dies and fall to the floor. This explains why the gutters were used under the dies and over the shaft, namely, to ward off and prevent clogging the shaft. This was all proven in the present suits, together with the identity of the machine, with its history—that is, the one now in possession of the McCullough Iron Company, of Philadelphia. Our expert, Mr. H. B. Renwick, testifies that "it is a number of Fischer machines laid side by side," and fully anticipates the fourth claim of the Fischer patent. There was no contradiction of this by Fischer; in fact, Fischer did not even put in any expert proofs whatever. During a conversation with the maker of this machine, I impressed him with the fact that the sustaining of the Fischer patent, though dated 1868, would make him an infringer should he take his machine, though built in 1851, and reduce it to one-sixth, as shown by the dotted lines *a* to *b*, Fig. 3. He fully realized this fact, and expressed himself as disgusted with such a state of things. I learned, also, that in 1851 a model and a drawing were made of this machine for the purpose of making an application for a patent, which application was abandoned, deeming it then, in face of the state of the art, as unpatentable. This fact appears in the records of this suit, in the form of an affidavit used in a motion which was made by me to dissolve the injunction.

Figs. 4 and 5 illustrate the dies of the English machines used in England, to my knowledge, since 1850, and are the dies arranged and used in the machine imported into New York from London in 1867, and which arrangement of dies was the subject of the suit "Fischer *vs.* Wilson *et al.*," which resulted in a decree sustaining the second and fourth claims of the Fischer patent. The fact of the using of these dies did not avail as a defense, as it had not been in public use in the United States two years or more prior to the patent of Fischer,



Figs. 4 and 5.—Dies of the English Machine, 1850–1867.

which constitutes a legal anticipation. The upper die of Fig. 4 is the ordinary female die as claimed by Fischer, while the lower die is the angle, or one of four male dies on the same block, which are held in position by counter-fitting blocks, while the hollows, or female dies, are found on the sides, and are used as shown in Fig. 5. Your readers will recognize in this the swage block of their forefathers.

Referring to Fig. 4, I distinctly remember that in my school days I was engaged in making a rabbit's house, (rabbits being one of my hobbies.) As I was an unskilled mechanic, and did not make my house as snug as I would wish, I took some strips of zinc, and with this very device I bent up angle pieces, which I used for nailing over the corners of my house. Little could I at this time have realized as a possibility that when engaged in the actual battle of life, the very act I then did, after a lapse of some thirty years, would be the subject of such a strife, in defense of which I should be called upon to expend thousands of dollars, years of valuable time, and under the color and by the erroneous acts of our courts of justice, stand under the stigma as a criminal with a sentence of fine or imprisonment hanging over my head. And this in a progressive nation, one claiming to be second to none in its enterprise and industries. Shame! O shame!

Fig. 6 illustrates the dies as designed by, and publicly used under the direction of, William E. Worthen, the celebrated civil and mechanical engineer, at the Althause Iron Works, in New York city. This arrangement of dies identically performs the same function as does the Fischer. Mr. Worthen testifies that

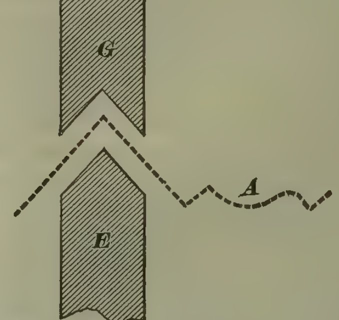


Fig. 6.—The Dies Used by Wm. E. Worthen, 1859.

"I have placed the female die above the male die, and have so used the machine for the purpose of making cornices long anterior to the date of this patent, . . . certainly eight years. . . . Sometimes the female die was above, and sometimes the male die, according to the requirements of the work and convenience. . . . The dies were all slip dies, and could be used by single couples or by gangs. . . . The surfaces of the dies were varied in form—sometimes angular and sometimes curved."

Fig. 7 illustrates the arrangement of dies in a machine used by Mr. Worthen at the Althause Iron

Works, in New York, in 1859 to 1862. The office of these dies was peculiar, though the identical functions of the fourth claim of the Fischer patent are there. The dies G and F are the Fischer dies pure and simple.

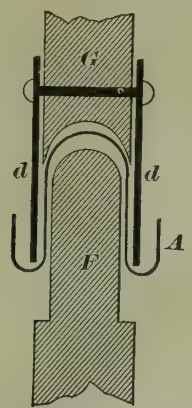


Fig. 7.—The Dies in Shutter Machine of W. E. Worthen, 1859-1862.

A length of band iron *d* was secured to each side of the female die G; the shutter slat A, which had previously been bent, was put upon the lower die F, and by an operation of the machine, the lower portion of the slat was formed upward. This is the machine that for years lay upon the sidewalk in Seventeenth street, between avenues A and B, exposed there for sale, and sold to some person for old iron within the past two years. It is claimed that more complete anticipations than Figs. 6 and 7 could not possibly exist. Fig. 7 was not used in the proofs for final issue, though it had been used in endeavoring to resist the motions for injunction, the court not giving it favorable consideration.

Fig. 8 illustrates a device in which is also embodied the identical claims of Fischer—to wit, the second and fourth, and is a device in common use in all can factories (Devoe's, Bostwick's and others). It is readily seen how moldings A can be formed on this machine; the diagonal position of the die E is such as to enable

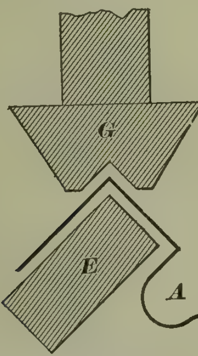


Fig. 8.—English Patent to Emile Peltier, August 27th, 1861.

them to curl underneath, and not to be crushed out of form, and also to make four sides of a square, one more than Fischer claims, while the upper aris or angle forms the male die. This patent was put in evidence without avail, and our expert testified it was an anticipation, and was not contradicted.

Fig. 9 illustrates another patented device for bending sheet metal, and was considered in the suit of "Fischer *vs.* Wilson *et al.*," by his honor Judge Blatchford, who held it was not an anticipation. It will be seen that, like Fig. 3, should Mr. Beach cut his patented device through at *a b*, and use it so, he would most assuredly infringe the patent of Fischer.

Fig. 10 illustrates the arrangement of dies in the Seeley machine for making clapboard iron. This arrangement of dies has been in use by Seeley, and his successors, Noyes & Wines, in New York, since 1862. Frequently upon this machine, prior to 1866, were made several lots of clapboard iron for the firm of Fischer Bros., of which firm Valentine Fischer, the patentee, is an active member, and there is no question of his entire knowledge of this arrangement of dies, and of the construction of the patented machine by which this device is operated. This machine is operated identically with the patented machine of Fischer. The reciprocating carriage is made to lift up and down by "a series of toggles," in precisely the same manner as claimed by Fischer in the seventh claim of his patent. It will be seen that, like Figs. 3 and 12, should the dies be cut through at *a b*, the use of either portion would be an infringement of the Fischer patent.

Fig. 11 illustrates the dies of a machine for corrugating sheet metal, and is in combination with other devices for the same purpose. It will be seen that while it does not fully anticipate the fourth claim of the Fischer patent, inasmuch as the female die is not vertically over the male die, the same result is attained, that of the female die clearing itself of dirt, scale, etc., and here we have the hollow standard of the second claim of the Fischer patent. Mr. Baker's first claim in his patent, reads: "First, corrugating sheet metals, etc., between alternating die paws (or their equivalents) in such a manner as to form but one bend or angle in the sheet at a time." What a pity Mr. Baker's ingenuity did not enable him to see a little further, and add: "For the purpose of keeping the female die clear, as set forth." He could have enriched himself, as Mr. Fischer has done. The human mind is indeed frail. This patent was not used in the defense of either of the

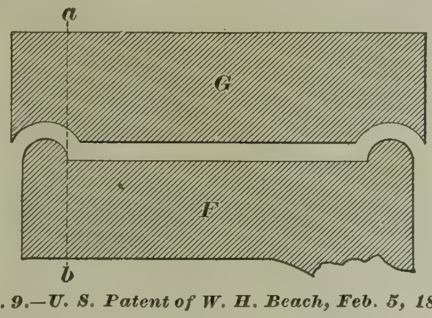


Fig. 9.—U. S. Patent of W. H. Beach, Feb. 5, 1861.

suits, as we did not discover it in time. By a reissue of this patent, changing the wording in a very slight manner, it would in itself annihilate the patent of Fischer. The old-fashioned clamp used so many years ago, was also provided with hollow jaws, in order that moldings should not be crushed out of form while additional bands were being made.

Last, but not least, comes the wonderful invention of Valentine Fischer, Fig. 12, the straw that broke the camel's back. Of this device, I shall only ask, Where is the invention?

A few words for the information of the inquirers as to the contempt branch of this case. The inference drawn from the use of the word "contempt," naturally is that I have been guilty of some infraction of the law or order of the court. This is nothing of the kind, for his honor Judge Blatchford, on one of the motions before him to punish me for contempt, declared me "not guilty" of a contempt, but designated it as "technical contempt," and ordered me to pay the cost of the proceeding—namely, $1,389.99 (now with interest added thereto). (I maintain that it was a proceeding most heinous in its character, and was a persecution and not a prosecution, as a pamphlet about to be published by

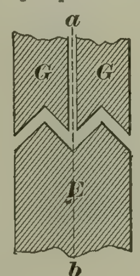


Fig. 10.—The Dies of the Seeley Machine, Patented in the U. S. Sept. 9, 1862, and Feb. 3, 1863.

me will clearly set forth.) His honor Judge Blatchford wrote an opinion in the case of "Fischer *vs.* Wilson *et al.*," susceptible of two interpretations, one of which I took (and, on the said motion to punish, his honor remarked that had he contemplated the interpretation I put upon it, he would have worded it differently). This opinion was studied by myself, then submitted to my expert, my counsel, and many of my mechanical friends, who all coincided with my views; and also at a subsequent time, when in court in company with my then counsel, his honor Judge Blatchford, taking in hand a model which belonged to me, stated that "the shoulders on this model may as well

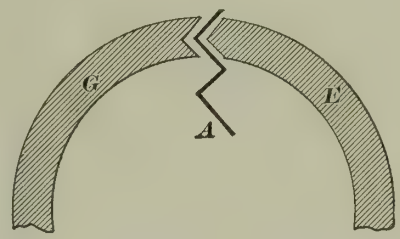


Fig. 11.—U. S. Patent to J. G. Baker, Dec. 6, 1863.

be a yard away as where they are; but if the shoulders or concavities were within the working faces of the dies, it would be a different matter." Now, I have done everything a loyal and true citizen could have done, on the service of the injunctive order upon me and in presence of the marshal serving it. I called my foreman into my office and ordered him to then and there desist from using the machine or dies, and my works were stopped from Friday to the following Tuesday, during which time the dies were altered, as I took it, to conform to the remarks of the judge and his published opinion. Then Fischer, desiring to follow me up, got one William Conolly to visit my neighborhood and peek through my windows, and make an affidavit that I was still using my machine and infringing the Fischer patent. Of this he could not swear satisfactorily to the judge, so an order was procured empowering Fischer, with his expert and counsel, to proceed to my place of business, and with a marshal and *posse* for the purpose of using force, if necessary, to enter my premises and compel me to operate any or all of my machines for their benefit, and also to compel me to testify against myself, in direct violation of

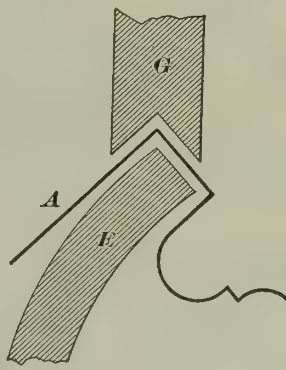


Fig. 12—U. S. Patent to Valentine Fischer, February 4, 1868.

the Constitution of the United States, so that Fischer could get a cause upon which to prosecute me. The *posse*, however, was not necessary, for the examination did take place, and while I was hundreds of miles away. On my return home, I was compelled to testify, and did; but my crime, for which I stand in jeopardy of my liberty, is not that of contempt, but of infringing an alleged patent.

The entire history of this remarkable case will be published in connection with future proceedings in another court of justice, where this matter must be more fully and finally adjudicated upon, and the real lawbreakers punished. Respectfully yours,

New York, March 7, 1881. GEO. HAYES.

P. S.—Since the above was written, I have been informed of still other anticipations of the Fischer patent, which I shall take pleasure in presenting to your readers at an early day, and which will still further strengthen my position, and show the injustice of the patent I am contesting. G. H.

A NEW FIRE-PROOF MATERIAL is now made of cotton and straw, both being treated to a solution and subjected to great pressure in process of manufacture.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	25 a 28
Spruce plank, 2-inch,	38 a — 40
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	15 a — 16
Hemlock joist, 3x4	16 a — 18
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	50 00 a — —
Oak	55 00 a 60 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	85 00 a 100 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	1 75 a — —
Yellow dressed pine flooring	30 00 a 37 50
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale per M.	2 50	a 3 00
Up Rivers	5 50	a 6 00
Jersey	5 00	a 5 50
Long Island	— —	a — —
Staten Island	8 50	a 8 75
Haverstraw Bay	6 25	a 6 37½
" " choice	6 50	a 6 75
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown per M.	10 00 a 11 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	— — a — —
Trenton	21 00 a 22 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	24 00 a 24 50
" Glengarnock	23 00 a 23 50
" Eglinton	21 50 a 22 00
" American, No. 1	25 00 a 26 00
" American, No. 2	22 00 a 22 50
" American, forge	20 00 a 21 00
	Store prices. Cash.
Bar, Swedes, ordinary sizes	— 6 a — 6¼
Bar, Swedes, nail-rod	— 6½ a — —

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7 a — 7¼
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a - —
do do No. 1, blue, in rough	- 85 a - 90
Bedford Stone	1 00 a - —
Berlin Freestone, in rough	- 85 a - 90
Berea Freestone, in rough	- 75 a - —
Brown Stone, Portland, Conn	1 05 a 1 30
Bay of Fundy Wood Point Brown Stone	1 00 a - —
do Mary Point Brown Stone	1 00 a - —
do do Olive Stone	1 00 a - —
Brown Stone, Belleville, N. J	1 25 a 1 75
Granite, rough	- 75 a 1 00
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a - —

PAINTS.

*Carmine, American, per lb gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8¼ a — 9
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 65 a 3 40
Portland (American)	2 25 a 2 50
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	2 00 a 3 00
Portland (German, Bonner)	2 85 a 3 25
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" " fine	10 50 a — —
Rosendale	1 00 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 25 a — —
Calcined, city casting	1 50 a — —
Calcined, city superfine	1 75 a — —

LIME—PER BARREL.

State, common	— 90 a — —
" finishing	1 15 a 1 25
Rockland, common, cargo rate	1 00 a — —
" finishing	1 25 a — —
Ground	— 95 a 1 00

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	1 75 a 2 00
Masons, do	2 75 a 3 00
Plasterers, do	3 00 a — —
Carpenters, do	2 75 a 3 00
Plumbers, do	2 50 a 3 00
Painters, do	2 50 a — —
Stone-Setters, do	2 75 a 3 00

DOORS, WINDOWS, AND BLINDS.

Doors, Raised Panels, Two Sides.

2.0 x 6.0	1¼ inch.	$ 90	——
2.6 x 6.6	1¼	1 20	——
2.6 x 6.8	1¼	1 25	——
2.8 x 6.8	1¼	1 30	——

Doors, Molded.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 48	——	——
2.6 x 6.6	1 56	1 95	——
2.6 x 6.8	1 80	2 28	——
2.6 x 6.10	1 83	2 33	——
2.6 x 7.0	1 97	2 36	——
3.8 x 6.8	1 88	2 39	3 33
2.8 x 7.0	2 04	2 46	3 46
2.10 x 6.10	2 21	2 54	3 56
2.0 x 7.0	1 98	2 69	3 80

Outside Blinds.

Up to 2.10 wide, per lineal foot	24 a —
Up to 3.1 wide	26 a —
Up to 3.4 wide	28 a —

Inside Blinds.

Per lineal foot, 4 folds, pine	53 a — —
Per lineal foot, 4 folds, ash or chestnut	— 77 a — —
Per lineal foot, 4 folds, cherry or butternut	— 96 a — —
Per lineal foot, 4 folds, black walnut	1 08 a — —

Window Frames.

Up to 3.4 x 7.2, put together	2 30 a — —

Review of the Markets.—In the lumber market the past month dealers have found some cause for complaint, owing to the fact that buyers have not yet made a sufficient distribution to neutralize the forced period of inactivity during the severe winter months, and are in consequence somewhat careful about handling additional supplies. As we write, however, a better feeling prevails and the prospects for a good spring trade are very flattering.

In the brick market some irregularity has prevailed with the final result more favorable to the selling interest, and as we close quite a steady tone prevails.

In the lath market trade has undergone no further decline and while as yet there has been a failure to secure a positive reaction the position has been steadier and more cheerful.

In the lime market trade has remained about the same as at our last writing. A good steady demand has prevailed, with some show of anxiety among dealers who have heretofore held off, and about everything offering from first hands are fresh arrivals finding customers. With this advantage, sellers have experienced no difficulty in maintaining former rates and the position has been very strong throughout.

In the hardware market trade has been very fair, with a tendency to gradually increase on all the regular outlets. Some little irregularity has occasionally been shown and values and buoyant tendencies held in check, but there have been no indications of buyers having obtained many advantages.

In the metal markets manufactured iron has met with a disappointing sale, the demand not taking anywhere near as much stock as hoped for, and the general run of supplies piling up at most points. Prices have been weak and unsettled on most kinds of stock. American pig has been delivered with some freedom in fulfillment of contracts made early in the year, but the fresh demand proved moderate and uncertain from all quarters. Scotch pig has sold slowly and the tone weakened, as some holders were a trifle anxious to realize with greater rapidity than the natural outlet permitted. Tin in pig has found a good jobbing demand, and, with the outside offering gradually disappearing, the market gained strength and holders manifested greater confidence. Tin plates have been held with steadiness and offered with moderation. Sheet zinc has been moderately active.

In the market for nails the aggregate of business has been full and on the increase.

In the paint market trade in a wholesale way has been without much animation, but in some instances very good sales have been made and full prices realized.

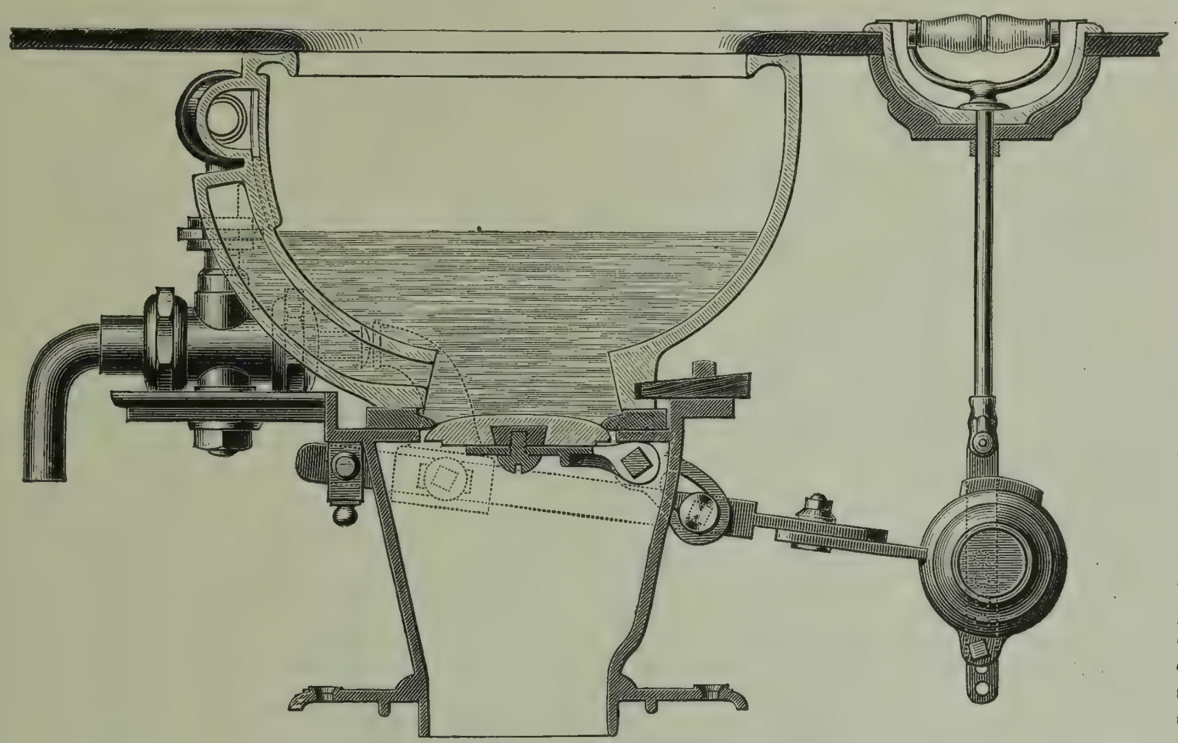
Fifty Millions.—The complete census returns from all sections of the United States, show the correct figures of our population to be 50,152,559, as compared with 38,558,371 in 1870, exhibiting, therefore, an increase of population in ten years of 11,594,188, or 30.8 per cent. Should the same rate of increase be continued for the next twenty years, the opening of the coming century will see the United States with a population not very far from 100,000,000.

Home Department.

Carr's Improved Water-Closet.

The accompanying cut gives a sectional view of a water-closet, possessing a number of excellent features which have gained for it a wide reputation and a very general introduction. The manufacturer has spared nothing to enhance the serviceability and durability of this apparatus. The closets are made almost entirely of china, the use of putty and cement being entirely discarded. The distinguishing features of these closets are, the large quantity of water retained in the bowl, the perfect sealing of the overflow, and the use of an effective seal in the bottom of the basin, in place of the usual pan. These closets are somewhat larger than those in general use, on which account the surface of water retained in the bowl is larger than the opening in the seat, a feature that has obvious advantages on the score of cleanliness. The seal at the bottom of the bowl fits up tightly and solidly against a bearing, as seen in the cut, thus offering an effective barrier against the entrance of foul and unwholesome gases from the sewer end of the apparatus—a feature which is decidedly to be preferred, on the score of safety, to the loosely fitting pans commonly used, which, even with a water-seal, afford inadequate protection from this source of danger.

The operation of the apparatus will be readily comprehended from the following statements, reference being made to the engraving: The raising of the pull opens the seal at the bottom of the bowl and discharges its contents, and, at the same time, the water supply is turned on by the pressure of the lever, shown in dotted lines against the head of the water faucet. The water enters the overflow, and from this is discharged into the basin, copiously flushing it with clean water. When the pull is lowered, the seal at the bottom of the basin is brought to its seat, and the overflow pipe is effectually sealed with the water in the basin. By this simple arrangement of parts, without unnecessary complications in construction, a water-closet is provided that is at once convenient, durable in service, and safe against the insidious dangers of sewer gases. Should repairs become necessary at any time, a duplicate of any part of the apparatus may be obtained of the manufacturer, Henry Huber (successor to Wm. S. Carr & Co.), 106, 108 and 110 Center street, this city.



CARR'S WATER-CLOSET—SECTIONAL VIEW.

In addition to the above described apparatus, the merits of which we have briefly pointed out, Mr. Huber, who has succeeded to the extensive business in general plumbers' supplies and sanitary appliances built up by the late firm of Wm. S. Carr & Co., manufactures a number of other special appliances, of which we may select some for description in future issues. Of these we may enumerate the patent "Monitor" closets, hopper closets for factories, prisons and asylums, patent swinging urinals, Carr's self-closing faucets, Carr's patent reversible pumps, and patent basin and bath supplies and overflows.

The J. L. Mott Iron Works.

The J. L. Mott Iron Works, 88 and 90 Beekman street, this city, have issued, in admirable style, a book of 250 pages, embracing illustrations and descriptions of the plumbing and sanitary appliances, and of a portion of the ornamental iron work, manufactured by them. Though primarily intended as an advertisement, the work contains so much information of a useful and practical character, that architects, plumbers, and others interested in the subject of household and public sanitation, will find it well worthy of preservation as a handy book of reference.

The catalogue contains illustrations and descriptions of a great variety of sinks, washstands and basins, bath and wash tubs, water closets and urinals, iron pipe and fittings, sanitary earthenware, lamp pillars, drinking fountains, stable fixtures, and other manufactures of the house too numerous to mention.

Glancing over the catalogue, the first impression one obtains, is surprise at the great variety of articles therein enumerated, every conceivable want that can be comprised within the line of their business having apparently been anticipated and met by ingenious special contrivances.

The portion of the catalogue relating to water-closets and their appurtenances, attracted our particular attention. It is devoted largely to illustrations of the improvements of Mr. Demarest, and known by his name; but in addition, the descriptive matter accompanying the engravings, fully explains the method of procedure of setting, making connections, and other practical points in connection with the arrangement of these indispensable adjuncts of the household, as to render the chapter devoted to it of real practical service to architects, builders, plumbers, and others whose profession or business demands a familiarity with these matters.

Of the other specialties described in the catalogue, we may note as particularly interesting, porcelain enameled baths in great variety; and in the ornamental department, the lamp pillars, drinking fountains and stable fixtures, as being distinguished for their admirable combination of utility with beauty of design.

The catalogue embraces so much, that we are able only to do it scant justice in this brief notice. It is in all respects highly creditable to the good taste and enterprise of the publishers.

To Clean Smoky Walls.—Brush them with a broom, then wash them over with strong pearlash water, and immediately rinse them with clean water before the pearlash is dry. When dry, give the walls a thin coat of freshly slacked lime, containing a liberal proportion of alum dissolved in hot water. Finish with whiting and good size. Be careful not to apply the size distemper till the lime wash is dry, as the latter will destroy the strength of the size if the two come in contact while wet.

Cooking with Steam Heat.

Steam has never been looked upon with special favor in the kitchen, and its use for cooking purposes has heretofore been rather limited. The prejudice against its use has doubtless been due in a great measure to the bungling devices employed in applying it, which generally resulted in producing sodden food, devoid of flavor. A new contrivance, the work of Mr. John Ashcroft, was successfully tested recently in the restaurant of Messrs. Nash & Crook in this city, when an entire dinner cooked with steam was served to a select company of the patrons of the establishment and a number of newspaper men. Soups, fish, roasts of beef and mutton and canvas-back duck, puddings, and other edibles were all cooked by the new process, and those who partook of the viands pronounced them excellently well cooked. The new process does away entirely with the use of stoves and ranges except for broiling purposes, and even broiling, it is believed, will be done much better by the steam oven than by an open fire. A device for so employing it has been put to some severe tests, and thus far has worked well, although it has not yet been put in general use. The steam ovens consist of vessels with double shells, one inside the other. The steam coming from a boiler is introduced by pipes into the space between the two shells. Radiation of the heat to the outside is prevented by a jacket of asbestos. The article to be baked is put in the vessel, where it is acted on by the heat derived from the steam, though the vapor nowhere touches the food. The quantity of the steam and the pressure are regulated by means of little wheels. There is no burning by the process, meats are not charred, their flavor does not pass off, the juices are preserved, and the kitchen is free from the usual disagreeable odors. Milk can be boiled without burning, and soups of delicate flavor can be prepared and kept better than with a stove or range. A great advantage of the new process is that no fires have to be kept lit as in a range, there is no dust or ashes flying about the kitchen, and the heat can be applied more speedily, and with less trouble than is the case with a range. The steam can be shut off or turned on at will, and after serving its purpose may be conveyed away for use in heating apartments. Wherever a steam boiler is used the ovens can be made available at a small expense. If the numerous steam heating companies, which have obtained permission to rip up the streets, ever get at work and supply steam heat to houses, the Ashcroft ovens will very likely come into general use in private houses, as they deservedly should, in view of the many advantages they possess over the cooking appliances in ordinary use.

Design for Cottage, Costing $4,000.

The subject of our architectural illustration this month, is a design for a cottage by Wm. H. Beers, architect, of 150 Broadway, this city. As will be seen by reference to the plates, an exceedingly picturesque effect has been obtained by the combination of a number of attractive features, and this at no sacrifice of convenience in the interior arrangement, which on this score is all that could be desired.

On the first floor there is a dining-room, 15 × 18 feet; kitchen, 15 × 16 feet; library, 13 × 20 feet; and a parlor, 15 × 20 feet. The main hall is 10 × 20 feet, and by it access can be had to any of the rooms on this floor, thus obviating the objection so common in houses of this class, of being obliged to pass through one room to gain access to another—often a source of very great annoyance. In the kitchen is provided a butler's pantry. On the second floor there are three chambers of the following respective dimensions, 15 × 16 feet; 15 × 15 feet; and 15 × 15 feet. There is also a hall bedroom 6 × 10 feet. The rooms on this floor are connected by a hallway, at the rear end of which a bathroom, with water-closet, is provided. The form of the roof is such as to leave a spacious attic, which is amply lighted and ventilated by a skylight.

Covering the entire front of the house is a broad piazza, adding not a little to the home-like character which the whole design suggests, and we think there can be but little doubt that the admirable effort of Mr. Beers will at once favorably strike the appreciative eyes of many of our readers.

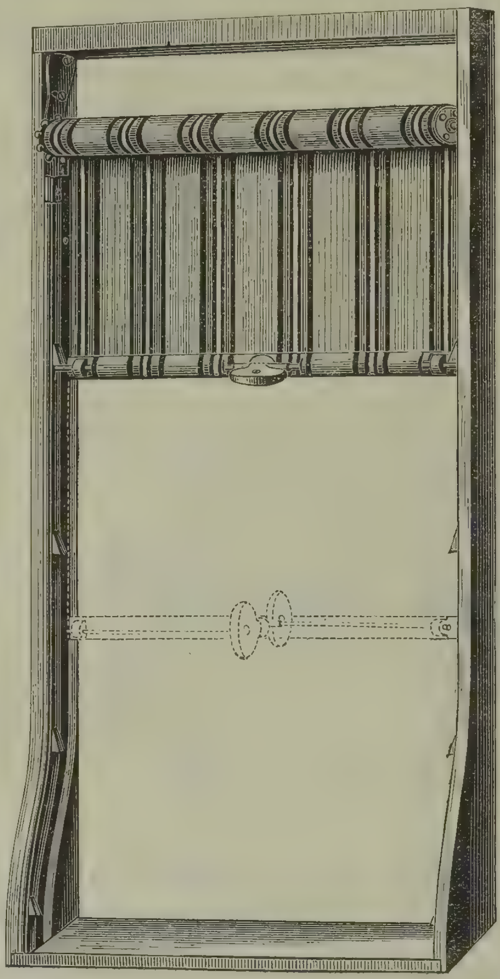
The estimated cost of this house, built in the best manner throughout, in the neighborhood of New York city, is $4,000.

Improved Curtain Fixture for Railway Cars.

The accompanying engraving gives a perspective view of an improvement in curtains for railway cars, devised and patented by William L. Washburn, of Brooklyn, N. Y. It is intended specially for use in connection with what are commonly known as summer or excursion cars, in which the sides are open, and provided with curtains for shielding the passengers from the sun and weather. Our readers are doubtless familiar with the arrangements in general use for this purpose at present. In most cases these curtains are arranged so as to roll up when not in use, and are fastened by strips after the manner of fastening carriage curtains. The edges, in like manner, are sometimes provided with button-holes for engaging with buttons in the frame of the car, to hold them in place when in use; or they are arranged to run up or down on vertical wire guides.

The object of the present invention is to provide for readily and quickly raising and lowering the curtain, for holding it securely in place in different positions, and for securing the edges of the curtain with relation to the frame of the car. It consists of a spring roller of any description which will accomplish the purpose of automatically rolling up the curtain when its lower portion is released. This roller is supported in brackets attached to the inner sides of the car window-frame, by a pivot, which allows the brackets to swing slightly, their play being limited by the presence of certain pins projecting from the window-frame. To the lateral edges of the curtain are stitched or riveted a number of metallic bars, which may be united across the curtain by means of wires. Each of these bars carries on its outer end a knob or head, which works in a metal groove or slotted tube, placed vertically in recesses in the sides of the window-frame. When the curtain is pulled down, the heads of the bars running in the guides hold the edges of the curtain securely in place. A spring in front of each bracket, in connection with the slight play of the bracket, secures the alignment as the diameter of the roll increases or decreases by lowering or raising. To hold the curtain down, two bolts are provided at the bottom, which may be engaged with stops placed at several points in the window-frame. The bolts may be engaged or disengaged by turning a thumb-piece provided for the purpose. By this arrangement the curtain may be secured at different hights between the top and bottom of the frame, as may be desired. When the bolts are released, the curtain rolls up automatically by the action of the spring roller, which also serves to keep the curtain taut in all positions. The arrangement by which the lateral edges of the curtain are set in between the inner and outer beads or cleats which support the slotted tubes, provides an effective barrier against the entrance of dirt and dust, rain and the rays of the sun.

The invention, as will be perceived from the above description, which will be readily understood in connection with the cut, seems to be well adapted for its intended purpose. It is now in use, we are informed,



Improved Curtain Fixture for Railway Cars.

on the Brooklyn, Flatbush & Coney Island Railroad.

The inventor's address is Wm. L. Washburn, 964 Dean street, Brooklyn, N. Y.

Miscellaneous and Advertising.

The Walworth Manufacturing Co., of Boston, have been awarded the contract for the steam warming and ventilating apparatus for the State Capitol building at Des Moines, Iowa, amounting to about $70,000. This is the third State Capitol building, as well as several hospitals and other large public buildings at the West, for which this company have received contracts.

"The Babcock & Wilcox Company" is the title of a new corporation commencing active business April 1st, and composed of the old firm of Babcock & Wilcox, to whose business it succeeds, and the principal members of the Singer Manufacturing Co. The Babcock & Wilcox boilers have made an enviable reputation in the market, over 30,000 horse-power having been sold last year, and the new company start with abundant facilities for extending the business to any desirable limit. [This seems to us one of the strongest combinations possible, and we are glad to note the success of Messrs. Babcock & Wilcox.—*Editor M. & B.*]

The Clayton Steam Pump and Air Compressor Works, of Brooklyn, N. Y., are pressed with orders for their air compressors, and their recent shipments embrace duplex compressors to Canada and Australia, (this probably being the first consignment of air compressors of American make to the latter place); a No. 7 duplex compressor, 18 inches diameter of cylinders by 24 inches stroke, to the Morris Run Coal Mining Co., of Pennsylvania, for use in running the Harrison coal-cutting machines; a No. 7 duplex to the Chateaugay Ore Co., Plattsburgh, N. Y.; two No. 4 duplex for use in sinking the caissons for the Bismarck bridge on the Northern Pacific Railroad; and some ten compressors of smaller sizes.

The following is a copy of the report of a test of 2,000 barrels of cement shipped by Brooks, Shoobridge & Co. to Quebec last year:

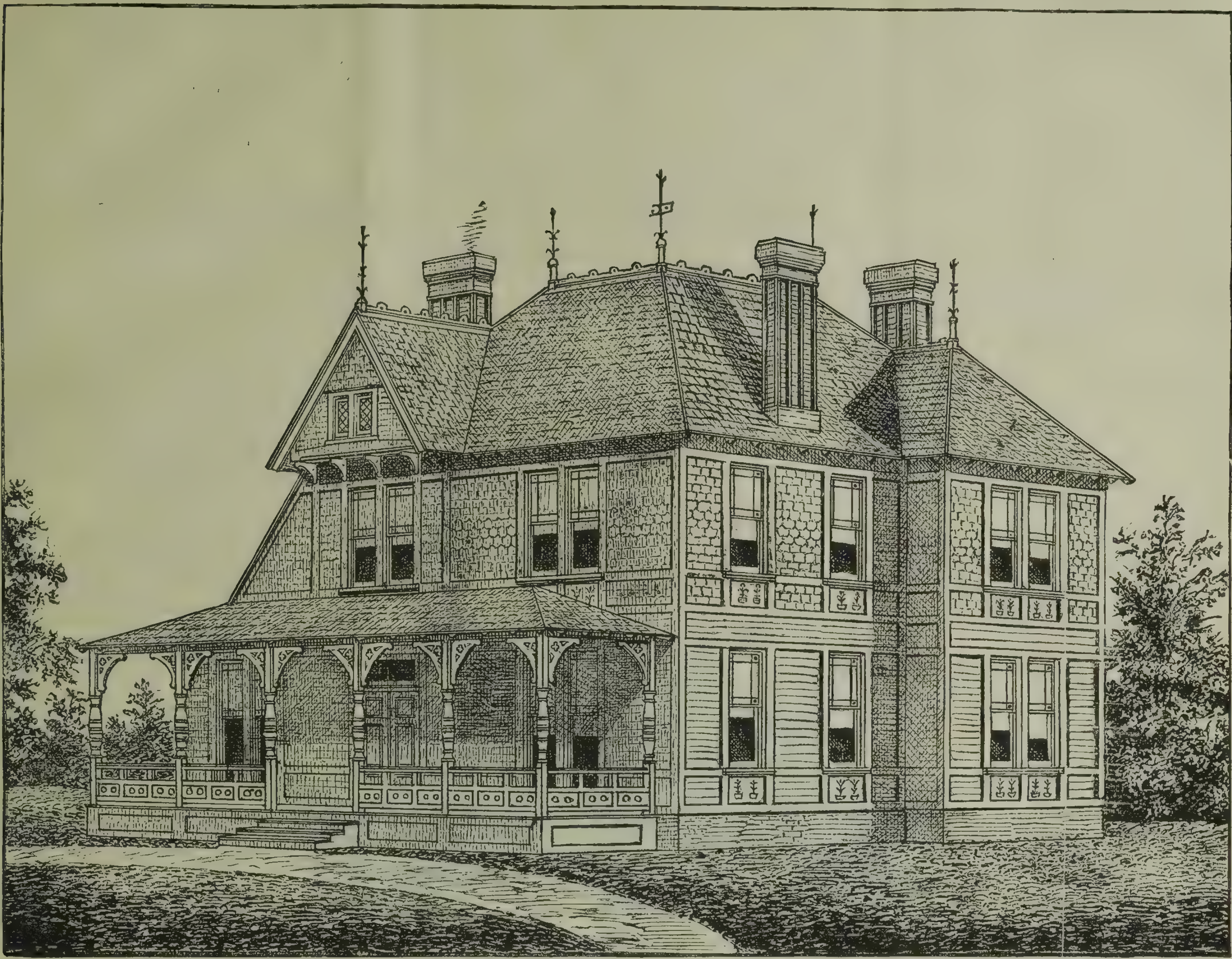
HARBOR IMPROVEMENT WORKS, QUEBEC, DEC. 28, 1880.
Larkin, Connolly & Co., Contractors, Point Levis, Quebec:

Dear Sirs: The cement tested, so far as supplied, for use under your contract for the construction of the Graving dock, at Point Levis, by Messrs. Brooks, Shoobridge & Co., of England, has proved fully up to the standard of the clause for this purpose provided under the specification. It seems to me to be a very carefully manufactured cement, very regular in its weight per strike bushel, while it is finer ground, having less residue than any cement yet offered here. Its breaking strain has averaged over 1,100 pounds on the briquette at seven days with Adie's machine.

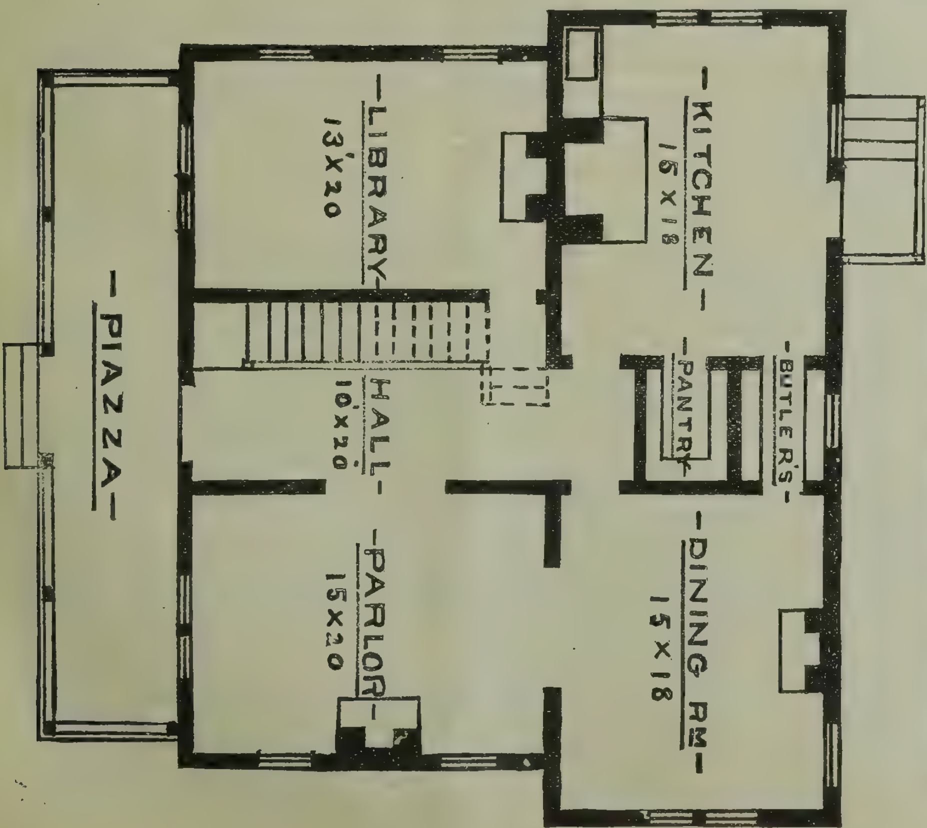
WOODFORD PILKINGTON, *Resident Engineer, M.I.C.E.*

To meet the imperative demands of a rapidly increasing business, the well-known firm of Smith, Vaile & Co., of Dayton, Ohio, manufacturers of steam pumps, have been obliged to undertake the erection of new and very much enlarged works in that city. The new buildings of the firm will be ready for occupation about July 1st. They will be of brick, and have the following dimensions: Machine shop, 250 × 60 feet; blacksmith shop, 40 × 40 feet; testing room, 24 × 60 feet; foundry, 60 × 120 feet; and in addition to these a boiler and engine room. When these buildings are completed and occupied, the company will be in possession of one of the largest establishments devoted to the manufacture of pumps in the country. The capacity of the new buildings will permit of the employment of 200 men. The new works will be furnished with power by an Allen-Corliss engine, and will be fitted with new machinery throughout. They will be conveniently located as respects transportation, being provided with side tracks from the D. & M. Railroad in their yards. The growth of this flourishing company will be best understood from the statement that they commenced operations six years ago, employing but six hands; they now rank among the largest manufacturers of steam pumps in the United States.

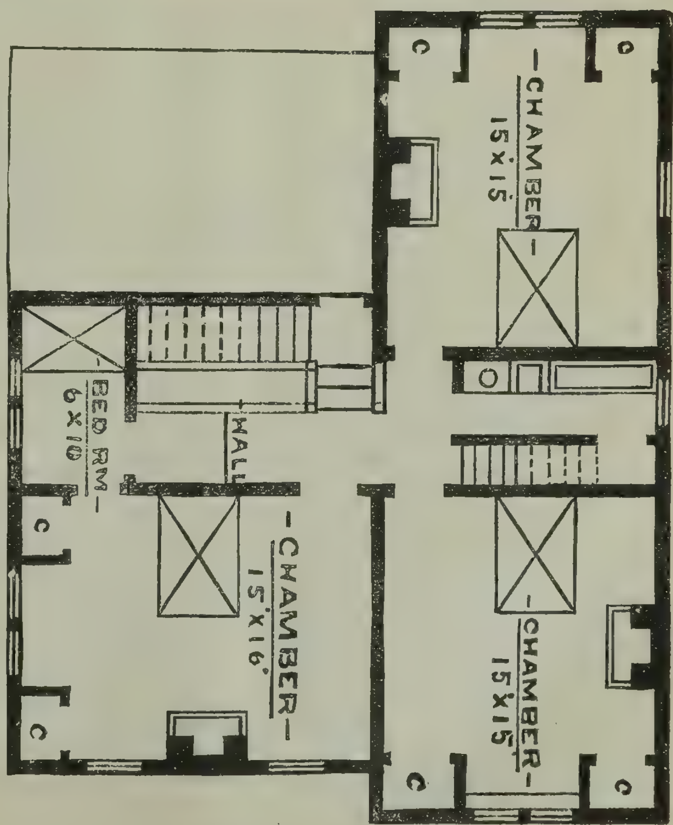
CATALOGUE OF SCHUTTE & GOEHRING.—We have received from A. Aller, of 109 Liberty street, New York, a copy of the new catalogue of Schutte & Goehring's steam jets and injectors, for which he is the sole agent for the States of New York, New Jersey and Connecticut. The catalogue is fully illustrated with a great variety of forms of jets and injectors adapted to special purposes in the arts and manufactures; and contains besides much useful information respecting the principles of their operation and their peculiar advantages. Of the merits of the steam jets and injectors manufactured by Messrs. Shutte & Goehring, we need say nothing, as their value is sufficiently proved by the very extensive introduction they have received, and to which introduction Mr. Aller has materially contributed. Besides the well known injectors for feeding locomotives and stationary boilers, the catalogue embraces descriptive illustrations of numerous forms of steam jet elevators (lifters) and ejectors for raising and forcing water, acids and other liquids, steam jet furnace blowers, ventilators, exhausters and air-compressors, and other forms of this universally applicable apparatus.



DESIGN FOR COTTAGE, COSTING $4,000.



First Floor Plan.

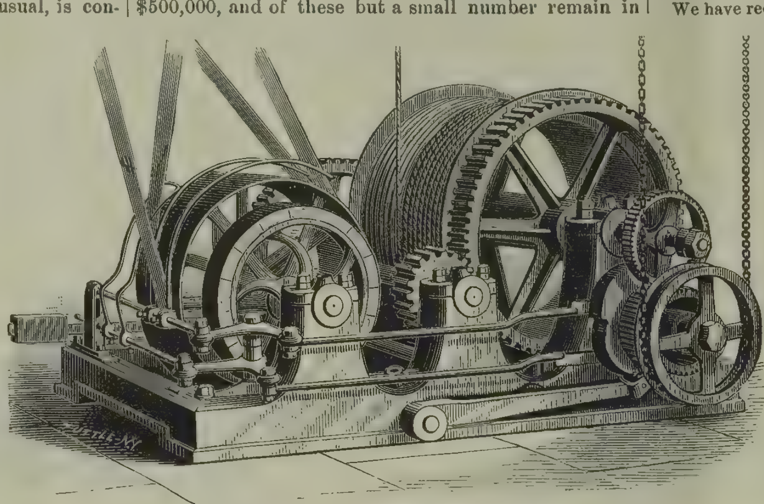


Second Floor Plan.

Double-Geared Hoisting Machine.

The machine herewith illustrated, and which has been specially designed for operating elevators, is manufactured by the Sherrill-Roper Air Engine Co., of 91 Washington street, New York. The machine will be recognized by some of our mechanical readers as having already acquired an established reputation by reason of its adaptability in style and construction for its intended purpose. Its special features are explained in the following description:

The frame of the machine is of iron, cast in a single piece, which avoids the objection of the displacement or settling out of line of any of the moving parts, insuring that these shall be held securely in place. The drum is large, turned and grooved for wire cable, and gears and shafts are well fitted. The brake band is lined with hard wood, and is held in contact with the wheel by a weighted lever attached to the brake rock-shaft. Another lever connected with the rock-shaft has a roller on its end, and serves to lift the brake-band as the cam which operates the belt-shifters is rotated. The outside of this cam is of a proper shape to lift and apply the brake at the necessary time, as the hoisting or lowering belt is shifted on or off the driving pulley. The other end of the brake-band, instead of being attached to a fixed point, as is usual, is connected to another rock-shaft, operated by an independent lever on the opposite side of the machine (not shown in the engraving). To this may be attached a rope running down the hatchway, convenient to the platform, which may be used to apply friction in lowering, should the engine be small and the load show any disposition to "run away" with it. It is at all times a "safety brake." A thread is cut on the end of the main shaft extending beyond the frame, and on this a gear fits freely, which engages with a wide gear on the cam shaft. Nuts are set on the ends of this thread, and adjusted so that at the top and the bottom of the building the small gear comes in contact with them, thus becomes fast, and, turning with the drum shaft, rotates the cam, shifts the belts and applies the brake.



Double-Geared Hoisting Machine.

This machine has been devised with particular reference to meeting the special requirements of its peculiar service; its simplicity, compactness and strength adapting it well to withstand the sudden strains and jars to which this class of machinery is subject, without suffering derangement.

The Silk Industry of the United States.

The following very able report by Consul Piexotto, of Lyons, will be read with interest not only by our silk manufacturers, but by every person who has the building up of our industries at heart. He says:

"The United States is no less interested in this serious question. We are now annually producing upwards of $30,000,000 worth of silk fabrics, and yet not one single silk filature worthy of the name exists in all our broad domains. Besides, we are wholly dependent upon Europe and Asia for our raw material. Two questions present themselves at this juncture: The first is, Can we raise silk? the second, Can we sell it when we have raised it? The first has already been solved; we can raise silk-worms, because we can grow the mulberry leaf which is its essential food. This question has been conclusively determined. Silk-worms have been successfully raised in the United States for more than 30 years. The second question remains; the impossibility hitherto of competing with the cheap labor of Europe, where the silk reeler receives but 30 cents a day, and of China and Japan, where but from 6 to 10 cents is paid, has been the principal, in fact the only, cause why we have not and could not sell the silk from the cocoon. Every silk manufacturer will admit the desirability, nay, for permanent success, the absolute necessity of having his raw material at hand, even as the cotton manufacturer has his. To be absolved from the necessity of importing from Europe and Asia the raw material, would be next to constituting the silk industry with us as one of the great sources of our national wealth. It would give employment to hundreds of thousands of hands—women and children, now idle or non-producing; it would at the same time afford the masses an elegant and durable material at one-third less than the present cost, and it would give to capital a new and lucrative source of investment shared at present but by a few individuals and restricted to exceedingly limited proportions."

Carpet-Making in Turkey.—One of the most important industries of the Ottoman empire, and certainly the chief industry of Asia Minor, always excepting agriculture, is the making of carpets. Some of the factories are now furnished with looms quite in the European manner, but it is not in such factories that these famous fabrics are chiefly produced; the peasants in their mud houses, and the nomad Yuruks in their tents, all contribute to the many kinds that are made. The annual value of the carpets of Anatolia approaches $500,000, and of these but a small number remain in Turkey. These large exports keep prices at a fair level, and in the best shops of London and Paris all kinds of Eastern carpets can be got for ready money more cheaply than the casual traveler can buy them on the spot. This applies to the finest old carpets as well as to the new ones, for even with a good and trusty dragoman one may have to lose the best part of a day haggling for half a dozen velvety mellowed Daghestans with a carpet dealer of Smyrna, Cairo or Alexandria, and after all be victimized to some extent.

New Publications.

Elementary Projection Drawing, Theory and Practice. For Preparatory and Higher Scientific Schools, Industrial and Normal Classes; and the Self-Instruction of Teachers, Inventors, Draughtsmen and Artisans. In six Divisions. By S. Edward Warren, C.E., former Professor in the Rensselaer Polytechnic Institute, etc. New York: John Wiley & Sons. 1880. 12mo, cloth, 24 plates.

This is a fifth edition, revised and enlarged, of a deservedly popular text-book on the theory and practice of industrial science drawing. Prof. Warren's volume can safely be commended to preparatory scientific schools, high schools and academies, and to those seeking guidance for self-instruction. The practice in too many so-called drawing schools is to set pupils to work at making copies of drawings laid before them, the result of which is that many, by dint of application, will be able in time to produce well executed drawings from copy. To make original projections, however, requires a knowledge of principles, which, with the aid of the progressive methods and problems in Prof. Warren's book, can be readily acquired. The subjects treated of in the book are embraced under the following divisions, which suffice also to indicate the scope of the work: Div. I. Projections—of simple solids, prisms, pyramids, cylinders, cones and spheres, and their intersections and developments; four plates. Div. II. Wood, Masonry and Metal Details, Carpentry Joints, etc.—to be drawn to scale from measurements; four plates. Div. III. Elementary Shadows and Shading—sufficient for ordinary practice, and with new examples; three plates. Div. IV. Isometrical and Oblique Projections, or Mechanical Perspective—easily learned and universally useful; four plates. Div. V. (New) Elements of Machines—cranks, eccentrics, toothed wheels, screws, etc.; four plates. Div. VI. Elementary Structures and Machines—an appropriate, practical summary of the preceding divisions, and with valuable new examples, a steam pump, an iron bridge, etc.; five plates.

Transactions of the American Institute of Mining Engineers. Vol. VIII. May, 1879 to February 1880. Easton, Pa.: Published by the Institute, at the Office of the Secretary, Lafayette College. 1880. From the Secretary.

The present volume of proceedings contains the transactions of the Pittsburgh meeting, May, 1879; the Montreal meeting, September, 1879; and the New York meeting, February, 1880; with the papers read thereat. The institute is growing in importance with each year that it adds to its existence. It embraces in its membership the foremost mining engineers, metallurgists, geologists, iron and steel manufacturers in the country, and the interest which they manifest in the society is attested by the very full attendance the meetings command, and, best of all, by the number and high character of the papers read. Among the authors who contribute to the present volume, we notice, in glancing over the table of contents, the well-known names of Holly, Raymond, Wurtz, MacFarlane, Egleston, Prime, Drown, and others equally active in scientific work. Like all of its predecessors, the present volume bears testimony to the careful revision of Dr. Drown.

Modern Architectural Designs and Details. Parts IV. and V. Plates. New York: Bicknell & Comstock. 1881. Price $1.

We have received the fourth and fifth parts of this valuable architectural work, and from a critical inspection of the same, feel justified in saying that the publishers have kept faith with their patrons in their prospectus. The parts already published, in the variety, extent and character of the plans and designs they cover, are probably not surpassed by any recent publication. The work, too, has the additional merit of being issued at a very moderate price, a fact which, taken in connection with the completeness with which it meets the wants of architects of to-day, enhances its practical value.

Like the preceding numbers, parts four and five each contain 8 plates, which are numbered respectively from 25 to 32 and from 33 to 40; and each embraces a variety of useful plans and designs.

The Age of Unreason. A Reply to Thomas Paine, Robert Ingersoll, Felix Adler, Rev. O. B. Frothingham, and other American Rationalists. By Rev. Henry A. Braun, D.D. New York: Martin B. Brown. 1881. Price 25 cents.

This very readable *brochure* is a vigorous and aggressive attack upon the rationalistic views of the popular writers and lecturers above named, from the pen of a Roman Catholic divine. As may be guessed, he handles his opponents without gloves, and the points he makes against them and their writings and sayings are telling, and frequently spiced with wit and eloquence. To those of our readers to whom the teachings of modern rationalism are distasteful, Dr. Braun's "Age of Unreason" will prove highly interesting; and to those who fully sympathize with the author's religious views, it will be at once instructive and edifying.

A Text-Book of Elementary Mechanics, for the Use of Colleges and Schools. By Edward S. Dana, Assistant Professor of Natural Philosophy in Yale College. New York: John Wiley & Sons. 1881.

The author, in his preface to the above work, explains that his reason for preparing it, was his inability to find among the many excellent works on mechanics, one that was fully adapted to his special requirements. He has, therefore, endeavored in this book to present the fundamental principles of the subject in logical order, in as clear, simple and concise a form as possible, yet without any sacrifice of strict accuracy. To make the subject as intelligible and interesting as possible, the author has introduced illustrations very freely. The work is confined to the mechanics of solids, as this forms a complete subject by itself. It has been prepared with special reference to use in the school-room, the subjects and problems being presented in paragraph form, each distinguished by a heavy black letter-title, to attract attention and facilitate reference. At the end of each division a number of examples are given, designed to test the ability of the student to apply the principles elucidated, to practice. The book, we think, will find favor with teachers.

Specifications for Frame Houses, Ranging in Cost from $2,000 *to* $20,000. By William T. Hallett, Architect. Third Edition (Revised and Enlarged). New York: Bicknell & Comstock.

This new edition of Mr. Hallett's work contains many important additions that greatly enhance its value. Among these is a glossary of architectural terms, schedule of architects' fees, a revised form of contract, and some facts which are worthy of being committed to memory. This work is hand-

somely made, the artistic arrangement of the title-cover and the neat typography of the specifications being especially creditable. Mr. Hallett's forms are now so generally used among architects and builders, that it would be superfluous to more than mention the special features of the new edition, as we have here done.

OTHER PUBLICATIONS RECEIVED.

Census Bulletin No. 76. Department of the Interior, Census Office, Washington, D. C. New York in part.

Transactions of the American Society of Civil Engineers. December, 1880. From the Society.

Shoe and Leather Reporter Annual for 1881. Published by the "Shoe and Leather Reporter," 17 Spruce street, New York.

Report of the Commissioner of Agriculture for the year 1879. Washington: Government Print. 1880. From the Commissioner.

Underwood's United States Treasury Counterfeit Detector. February, 1881. Washington: A. S. Pratt & Son. From the Publishers.

Quarterly Report of the Chief of the Bureau of Statistics, Treasury Department, relative to the imports, exports, immigration and navigation of the United States, for the three months ended September 30th, 1880; also containing other statistics relative to the trade and industry of the country. Washington: Government Printing Office. 1881.

Correspondence.

LOOSENING GLASS STOPPERS.

To the Editor of the Manufacturer and Builder:

I have before me the August number of the Manufacturer and Builder for 1880. Your correspondent, B. F. S., (Query 2661) asks for the simplest and easiest process to loosen glass stoppers. The process you describe may effect their removal, but a few light taps or blows with a pocket-knife, or any light substance, will in all cases loosen them without danger to the operator or contents. This I know from actual experience in the most obstinate cases where heat had no effect; the blows being light, jar and so loosen the stopper. This you can recommend in all cases. A. W. Phelps.

Naugatuck, Conn.

REPLY.

We do not agree with our correspondent's suggestion. From many years' experience in the laboratory, we can say with the utmost positiveness that the method we propose, of gently heating the neck of a bottle to loosen an obstinate stopper, is the safest, and generally the quickest method of procedure. We have never known it to fail of success, when properly done, and the risk of breaking the bottle, except in inexperienced hands, is very slight. Stoppers are often so tightly wedged, or become so firmly cemented to the neck of the bottle by the efflorescence or drying out of the contents, that no amount of tapping, short of breaking away the neck, (stopper and all), will suffice to open the bottle. But in support of our recommendation, we may add that we have again and again seen an obstinate stopper, that had resisted the most patient and careful tapping, yield almost instantly after gently heating the neck of the bottle. Loosening stoppers by tapping is generally the first method tried in case of such a difficulty, and where it can be done, it is certainly the simplest and most expeditious method, though it requires careful calculation of the force of the blows, to avoid knocking away the neck. We would hardly call a stopper, that would yield to this procedure, a really "obstinate" one. If our correspondent should happen across one of the real tight ones that we get hold of almost every day in the laboratory, he would find his plan of little avail, save to break his bottles.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2787) Colored Fires.—Please publish in your answers to correspondents some practical recipes for making colored fires, so that an unskilled person may be able to make them, and oblige.—S. M. C., Washington, D. C.

(2788) Salting Meat.—Is it true that salted meat is not so wholesome and nutritious as fresh? Please answer and oblige. —J. A. W., Dallas, Mo.

(2789) Fleuss' Diving Apparatus.—I have read with much interest the accounts which have appeared in your journal and others, of the utility of the Fleuss diving apparatus, and would like to have your own opinion of its value.—A. R. W., Nashville, Tenn.

(2790) Oxidizing Silver.—Please inform me how to make the oxidized silver surface on ornamental objects of silver, and oblige.—J. Van Z., Camden, N. J.

(2791) To Make a Battery.—I have been a reader of your valuable journal for some time, and take great interest in your "Notes and Queries" department, and would be thankful to have you answer the following: How can I make a cheap battery for an amateur?—L. L., Tolodo, O.

(2792) Foaming in Steam Boilers.—Will you please explain what causes foaming in a steam boiler, and how to prevent it.—S. R., Conway, N. H.

(2793) Works on Chemistry.—Are there any books for practicable amateurs published on electricity, chemistry, and chemical experiments?—L. L., Toledo, O.

(2794) Lifting Tackle.—On page 13 of your January number for this year, under the subject of "Lifting Tackle," is Fig. 8, butt or end sling, illustrated correctly? Should not the rope cross itself at the front—the reverse from what is shown—to be more safe, as I here give it?—J. H. C., Providence, R. I.

(2795) Capacity of a Steam Boiler.—We have a boiler 40 inches diameter, 18 feet long, with two 14-inch flues, stack 40 feet high, and grate surface 4 feet by 4 feet 6 inches. Is such a boiler large enough to run an engine of 10 × 20 at 100 revolutions per minute, with 70 pounds steam pressure, to its full capacity, using a force pump direct from the engine for feeding boiler, with a good coil heater? Or would it be better to lengthen the boiler, say 6 feet?—L. W., Ironton, O.

(2796) Uses of Paraffin.—If you can conveniently do so, please give me a list of the uses made of paraffin.—P. R. V., Montgomery, Ala.

(2797) Plaster Casts of Fish.—I will be obliged if you will give me some hints as to the proper method of making plaster casts of fish, for the purpose of preserving the same as museum specimens.—J. G., Keokuk, Ia.

(2798) Varieties of Coal.—Will you please explain what the difference is between anthracite, bituminous and semi-bituminous coal, and oblige.—J. McQ., Salem, N. J.

(2799) Burning Fluid.—What is the composition of the burning fluid very generally used in lamps before the introduction of petroleum? It was a colorless liquid, limpid like water, and, as nearly as I can remember, smelt strongly of turpentine. —J. S. R., New London, Conn.

(2800) Soda and Fustic.—Please inform me whether you think carbonate of soda and fustic, used as an anti-incrustator in a brewery steam boiler, would interfere with fermentation or injure the beer in any way. I suppose live steam may be used to boil some of the liquids.—R. G., Philadelphia, Pa.

REPLIES.

Rule for Horse-Power.—Referring to the number of inquiries we receive respecting the estimation of horse-power, we may supplement our previous replies by the following useful method of approximation proposed by Prof. R. H. Thurston, a well-known authority on steam engineering. We give his rule as we find it in Barr's "Steam Boilers." Prof. Thurston estimates that for the *best* steam engines (those using high pressures and working expansively), the quantity of water required to be evaporated, per hour per horse-power, is equal to the constant 150, divided by the square root of the pressure. The horse-power here is to be understood as that furnished by the indicator. The quantity of water required for the best Corliss engines, for example, using steam at 100 pounds pressure, would be ascertained by this formula, as follows: Square root of 100=10; then

$$\frac{150}{10}=15$$

pounds of water are required per hour per indicated horse-power, or about ¼ of a cubic foot. This, it should be understood, takes no account whatever of the losses incident to the generation of steam, but shows what the demand of the engine is upon the boiler. For *good* engines, he increases the constant to 200. This would give for the same pressure 20 pounds of water, which accords closely with good average practice for high grade engines. Mr. Barr proposes to carry this rule still further, by assuming the value of the constant at 350 for plain slide-valve engines. This class of engines use steam of lower initial pressure, and with less economy than those above referred to. The usual point of cutting-off is two-thirds stroke, which allows but one-third for expansion. If an initial pressure on the piston be assumed to be 50 pounds, or, to get rid of a fraction, say 49 pounds, the rule would give us: Square root of 49=7; then

$$\frac{350}{7}=50$$

pounds of water required per hour per horse-power, or nearly five-sixths of a foot; which will be recognized likewise as being in close accord with good average practice with this class of engines.

(2787) Colored Fires.—We give in the following several recipes for making colored fires, but wish to caution this inquirer in advance, as he confesses himself unskilled, or ignorant of the nature of the chemical substances employed, that unless the greatest caution is exercised in the mixture of the ingredients, an accident from the explosion or ignition of the mass may take place. To avoid this, he should observe the following precautions: These fires should never be made until they are wanted for use, as from their ready combustibility they are liable to give rise to accidents. The ingredients should first be *separately* reduced to the state of a fine powder. The mixture should be made with small quantities at a time; best on a piece of white paper, with a wooden spoon or spatula, and by turning the mass over and over, *not* by friction or rubbing. As an extra precaution, an amateur should in every case dampen the ingredients slightly, before mixing, with a little strong alcohol. By observing these rules, the operator will avoid the liability to accident which is to be feared with such highly combustible mixtures as these. The following recipes give characteristic colors:

RED FIRE.

	a	*b*	*c*	*d*	*e*	*f*	*g*	
Chlorate of potassium....	24	32	20	40	16	10	..	parts.
Nitrate of strontium.....	30	48	20	39	60	68	..	"
Sulphur.............. ..	18	18	20	18	21	22	4	"
Nitrate of potassium.....	8	..	10	..	..	..	..	"
Sulphide of antimony.. .	8	6	6	..	..	..	..	"
Charcoal	4	2	1	3	1½	¾	..	"
Sugar...................	..	..	2	..	..	..	..	"
Shellac (powdered).......	..	..	..	..	..	..	1	"

Of the above, *a* is brilliant and moderately quick burning; *b* gives the most intense red, and burns quickly; *c* and *f* burn slowly; *d* burns quickly; *e* less quickly; and *g* burns slowly, but brilliantly.

BLUE FIRE.

	a	*b*	*c*	
Chlorate of potassium..............	50	25	30	parts.
Nitrate of potassium...............	..	50	40	"
Ammonio-sulphate of copper.......	25	..	..	"
Ammonio-nitrate of copper.........	..	..	20	"
Carbonate of copper................	..	12	..	"
Sulphur..........................	12	16	16	"
Charcoal.......	16	12	16	"
Alum (burnt)......................	..	..	10	"

The first of these gives a much darker blue than the others.

GREEN FIRE.

	a	*b*	*c*	*d*	
Chlorate of potassium........	35	20	36	9	parts.
Nitrate of barium............	45	20	20	70	"
Sulphur......................	10	8	24	21	"
Charcoal....................	6	5	..	..	"
Calomel......................	..	10	..	..	"
Sulphide of antimony........	..	5	..	..	"
Nitrate of potassium.........	..	20	..	..	"
Rosin	..	5	..	..	"

Mixture *a* gives the most brilliant green; *a*, *b* and *c* burn quickly, and *d* slowly.

VIOLET FIRE.

	a	*b*	*c*	*d*	*e*	
Chlorate of potassium..........	30	50	40	52	51	parts.
Nitrate of potassium..........	..	20	30	..	..	"
Nitrate of strontium..........	20	..	20	..	..	"
Precipitated chalk............	..	..	..	29	10	"
Carbonate of potassium...	..	10	..	..	..	"
Sulphide of copper.......	..	..	20	4	..	"
Carbonate of copper..........	..	..	..	..	24	"
Calomel...........	2	..	8	..	..	"
Sulphur...........	20	15	12	15	15	"
Charcoal	5	4	6	..	..	"
Ammonio-nitrate of copper....	15	..	..	..	..	"

Mixture *a* burns moderately quick, and gives the deepest violet; *b* burns quickly; *c* less so; *d* rapidly; and *e* slowly.

WHITE FIRE.

	a	*b*	*c*	
Nitrate of potassium..............	100	63	75	parts.
Sulphur........................	30	21	15	"
Realgar........................	9	..	..	"
Sulphide of antimony............	..	6	..	"
Gunpowder flour.................	..	36	200	"
Carbonate of potassium..........	..	5	..	"
Charcoal.......................	..	..	120	"

Of these, *a* is only suited to be used in the open air, because of the poisonous arsenical fumes which it evolves. The mixture *c* can be made to burn slower by slightly increasing the proportion of charcoal. There are other recipes for different colors that we could add, but those above given cover quite a variety, and will probably answer our inquirer's purpose.

(2788) Salting Meat.—Salted meat is far less nourishing than fresh, and far less wholesome. We will endeavor to explain why. The preservation of meat by means of salt has been practiced from time immemorial, and is one of the simplest methods for this purpose. It depends for its efficiency upon the dessication or drying of the tissues, as the salt used for this purpose enters slowly into solution, deriving the moisture it requires for this purpose from the fluids of the flesh. Hence it is that when dry salt is strewed upon fresh lean meat, it gradually disappears in the form of a liquid brine. As the flesh loses its natural juices, the fibers contract and the meat lessens in bulk. The action of the salt, if a large quantity is applied, penetrates deeply, and as much as one-third of the natural juice of the meat is often forced out of it. The preservation of meat by means of salt, therefore, may be explained to depend upon the separation of water, upon the exclusion of air, and upon the saturation with salt of the juices remaining in the meat. But meat, though preserved in this manner against putrefaction, suffers a notable loss of its normal nutritive properties, inasmuch as the brine which gradually forms about it, contains probably one-third or one-half of the nutritive substances (albumen, kreatin, phosphoric acid, potash, etc.) of the flesh, which are extracted along with the juices. These are the very substances which are more completely extracted by digestion with water, as in making beef tea or broth; and in proportion as these constituents are extracted, they diminish the nutritive properties of the meat. The change in the con-

stitution of the meat by salting has been shown by Liebig to be greater than that produced by cooking, and the loss of nutritive value considerably greater; for in cooking, the nutritive albumen, etc., is simply coagulated in the fibers and retained, while in salting the extracted substances enter the brine and are lost. Not only does salting greatly diminish the nutritive value of meat, but those who are compelled to subsist upon it almost exclusively for any length of time, are generally afflicted with scurvy, a fact which proves its unwholesomeness, and which doubtless stands in close relation with the loss of the nutritive elements, as vegetable substances which are capable of supplying what the meat has lost, are found to be the best preventive of, and the best remedy against, the disease.

(2789) Fleuss' Diving Apparatus.—The statements concerning the Fluess diving apparatus, we think are entirely to be relied upon. His public exhibitions at the London aquarium, and elsewhere, have fully demonstrated that a diver equipped with the apparatus may remain under water, and move about freely, for several hours at a time, without the necessity of receiving a constant supply of air from above, and with no other connection with the surface than the signal rope as a means of communication. These facts are vouched for upon indisputable evidence, and we are decidedly of opinion that the Fleuss apparatus marks an era in the history of submarine operations. Mr. Fleuss has manifestly struck upon the right principle in the construction of his apparatus, in furnishing the diver with his own air supply, under normal pressure, which he can draw upon as it may be required, and with which he can remain under water without inconvenience until it is exhausted. We expect to see this apparatus, or others on the same principle, speedily take the place of the cumbersome, impractical and very much inferior apparatus at present in general use for submarine operations. Just after penning the above, our eye was caught by a paragraph, which is given on good authority, and which strongly confirms our opinion of the value of this new apparatus. It is as follows: "Fleuss' diving apparatus, which we described several months ago, has been used with success at the Severn tunnel, by a professional diver, who with it reached the bottom of the shaft under 35 feet of water, and walked more than a thousand feet up a heading to close some sluices and shut an iron door. *He was cut off from all communication for an hour and a half.* The ordinary diving gear had been tried for this work, without success, for the great length of tubing required in connection with it rendered its use impracticable." This case of itself testifies in the strongest manner to the utility of this apparatus.

(2790) Oxidizing Silver.—The appearance, technically called oxidation, on a silver (or silver-plated) surface, may be obtained by any one of the following methods. The effect is often very pleasing on silver work when the process is artistically done. Dissolve about a gramme (or pennyweight) of platinum in aqua regia (a mixture of 3 parts of muriatic with one of nitric acid), and evaporate the acid off completely upon the water bath. Dissolve the resulting reddish mass—bi-chloride of platinum—in a little sulphuric ether or alcohol. Apply the solution with a camel's-hair brush to the parts that require to be oxidized, and as soon as the ether or spirit has evaporated, the film of platinum remaining will give the required appearance to the silver surface. The acid solution, before evaporation, may be used instead of the above; or an aqueous solution of platinum chloride, but the first named method gives the most satisfactory results. Another method is as follows: Take sulphate of copper (blue stone), 2 pennyweights; nitrate of potassa (saltpeter), 1 pennyweight; chloride of ammonium (sal ammoniac), 2 pennyweights; dissolve in acetic acid, and apply with a camel's-hair brush, first warming the object before making the application. A simpler process than either of the foregoing, though its effects are not so permanent, consists in simply applying to the parts to be oxidized a solution of sulphide of ammonium. Sulphur fumes will give a silver surface a beautiful steel-blue color. The operation should be done in a close box, and all parts of the silver article not to be affected, should be protected from the fumes of the burning sulphur by a suitable coating of wax.

(2791) To Make a Battery.—In answering this query, we will say that probably the simplest and cheapest battery to construct is what is known as the Smee. In this each cell consists of a glass jar, of any desired size, containing sulphuric acid. The plates and the attachments are provided as follows: A rectangular base piece of wood is provided with a pair of uprights at each end, in which a cross-bar, carrying the plates, can be supported by passing a pin through holes in the uprights and the cross-bar. From this cross-bar are suspended a series of plates alternately of zinc and silver (or copper, silver-plated), in such a manner that each cup shall contain a zinc-silver couple, and the zinc plate of one cup is connected by a copper band to the silver of the next. The copper band of the terminal zinc and silver plate of the set is furnished with a thumb-screw, to which copper wires may be attached. When these are connected the circuit is complete. In some cases the zinc plate is bent upon itself in such a manner as to surround the silver plate. The series of cells may be increased to any extent. Instead of the arrangement described for raising and lowering the plates out of, and immersing them into, the liquid, a pulley and lever, or some equivalent mechanical device, may be used in its place. This battery is feeble but steady, and may be charged and left for a long time without deterioration. It must not be forgotten that when the battery is not in use, the plates should be raised out of the exciting liquid. Another form of battery, much used in telegraphy, is the so-called gravity battery, which gives a feeble but very constant current. It is a modification of the Daniell battery. This battery is made by suspending a disk of zinc near the top of a glass jar, and placing a copper plate at the bottom, and then filling the jar with a saturated solution of sulphate of copper (bluestone) and a diluted solution of sulphate of zinc. The difference in the specific gravity of the two solutions causes them to separate at once and to become superposed in the jar, the sulphate of copper occupying the lower and the sulphate of zinc the upper portion. The disk of zinc is cast in the form of a set of segments, and is suspended from the top of the jar by a tripod resting on the edge of the glass. The connecting wires from the zinc and copper plates are provided as in the case of the Smee before described. A surplus of crystals of bluestone should be placed in the bottom of the cell, on which the copper plate may rest. The zinc plates of both batteries should be amalgamated.

(2792) Foaming in Steam Boilers.—Foaming in steam boilers may occur from several causes—defective construction or careless management. The most common cause is doubtless faulty construction, as where boilers with a large amount of heating surface have an insufficient steam room, and especially where these faults are combined with such an arrangement of the internal parts as to hinder free and rapid circulation. Besides this, boilers will foam when they are unduly charged with dirt, grease or soapy substances; from excessive firing; by changing the water from fresh to salt (in marine boilers); and from other causes. The remedies, in a general way, are to provide ample steam room and good circulation, to keep the boiler clean, and to fire moderately. Each particular case must of course be understood, and the appropriate remedy applied. If our correspondent is troubled in this way, let him send us the details of his case, and we will endeavor to advise him.

(2793) Works on Chemistry.—"Manual of Inorganic Chemistry," by Eliot and Storer, price \$2.75; "Chemical Experimentation," by Prof. L. P. Sadtler, \$2.50; "The Forces of Nature," by Guillermin, \$6.50; Tyndall's "Lectures on Electricity," \$1.25, are all useful and valuable works, and we can furnish the same postpaid at the prices given. Our correspondent does not give us sufficiently explicit information in his question to enable us to judge of the precise nature of the books he wants.

(2794) Lifting Tackle.—The suggestion of this correspondent to reverse the crossing of the rope in Fig. 8, page 13 of our January issue, in the cut showing the "but or end sling," would be advantageous in laying the upright parts of the rope closer to the object lifted, and in a better position to bind closely as strain is applied; but the mode of crossing shown in the original lays the tackle closer to the object in the cross fold. What is gained, therefore, in the one case is lost in the other; so that no advantage would result from the change proposed.

(2795) Capacity of a Steam Boiler.—Replying to L. W., we would state that his boiler, counting 6 inches above its middle, where it should be bricked in, and counting six-10ths of the flue internal surface, gives about 190 square feet of heating surface. This may be divided by 9, for the horse-power of a plain slide-valve engine requirement, giving 21 horse-power under the ordinary usage. The grate surface is equal to 32 horse-power; and a 10×20-inch cylinder engine is usually called a 20 horse-power engine. If by the words "full capacity," L. W. means the usual rating of a 10-inch cylinder engine, with good draft, the boiler, as it is, is all that he requires. If, however, the engine is made for high speed and hard work, with liberal material and wearing surfaces, and he requires to have say 30 horse-power constantly, then he had better add, as he suggests, 6 feet to the boiler's length.

(2796) Uses of Paraffin.—Paraffin has many important uses in the arts. The most extensive application made of it, is probably in the manufacture of candles. For this purpose it is cheaper than wax, and the candles are claimed to furnish a light superior to that of any other variety. Paraffin is also extensively consumed in a variety of ways as a water-proofing agent, an application for which its perfectly neutral chemical properties excellently adapt it. Thus it is used for water-proofing textile fabrics of cotton, woolen, and even silk. Sometimes it is used for this purpose in the form of a solution in naphtha, for water-proofing felt hats, umbrellas and silk goods generally; also for water-proofing paper. It is largely used for hermetically sealing vessels containing liquids, to prevent the evaporation or leakage of their contents. For this purpose it is used for coating the interior of wine and beer barrels. It is used for saturating corks for the same purpose. Large quantities are used for the apparently trivial and unimportant purpose of manufacturing chewing-gum. The extent to which this simple article is sold by wholesale confectioners must be simply enormous, as we have information that one manufacturer of chewing-gum alone uses about 70,000 pounds of paraffin in a single year. Confectioners also use it considerably to impart to certain of their confections a high gloss or luster. Paraffin is also used very largely in the laundry as an addition to starch, because of its property of giving laundried articles an additional luster. Large quantities are also used to adulterate wax. It is used in large quantities by the manufacturers of friction matches, to impregnate their sticks and cause them to burn freely when ignited, as well as to water-proof the tips. One of its most important uses is that of an insulating material in telegraphy. In addition to the above, we may add in conclusion that paraffin is used to some extent for sizing or finishing textile fabrics, as well as leather and small articles turned from wood or bone, for the preservation of timber, for preserving fruits, eggs and the like against decay, for protecting fresco paintings, and for many similar uses.

(2797) Plaster Casts of Fish.—The following is said to be the method of making plaster casts of fishes adopted and used by the United States Commission of Fish and Fisheries, whose admirable exhibit of casts at the Centennial Exhibition were the theme of universal praise. Fish are taken as fresh and perfect as possible, wiped with a cloth, not only to dry the moisture, but to remove the mucous secretions. The fish is then laid on a flat, smooth board, and placed in a natural position by means of little lumps or wedges of potters' clay, raising the parts liable to drop below the axis of the fish. The fins are spread out upon flat cushions made of potters' clay, and are kept in their spread condition by means of pins. When the fish has been firmly set in a natural position, a rather thin mixture of plaster of Paris and water is poured over it, and repeated coatings of this material are applied until a sufficient thickness is attained, when it is allowed to set moderately hard. The mold is now turned over, and the fish removed. When the cast is made, a slight coating of shellac varnish is applied throughout the inside of the mold. The plaster of Paris mixture is then poured in, and when sufficiently "set," the mold is chiseled away, the shellac coat guiding the workman as to the depth it is safe to cut. The cast is now trimmed of its rough edges and projections, and a square, stiff frame having been made, with the inner edges studded with nails, the cast is placed within it, lying on a flat table, and plaster of Paris is then poured within the frame until it rises to the level of the edges. Embracing the base of the cast, it also adheres firmly to the inside of the frame, and when "set," is lifted from the table. The plaster matrix, which now becomes the background of the fish, is smoothed. The plaster cast is now ready for coloring. The above directions are sufficiently explicit to enable any intelligent person with a little mechanical skill, to turn out very creditable work of this kind. The subsequent coloring of the fish cast, to give it the natural appearance of the original, requires considerable artistic skill.

(2798) Varieties of Coal.—The beds of mineral coal which occur in numerous regions, are known to have been derived from ancient vegetation, which in past times was buried in the earth, and subsequently subjected to a slow charring process. By this charring, the volatile constituents of the vegetable matter are more or less perfectly driven off, and the character of the several varieties of coal depends upon the extent to which this alteration of the original vegetable substance has progressed. In anthracite coal, which is the most perfectly mineralized of all the varieties of coal, the volatile substances have been completely, or nearly completely, expelled, and that which is left behind is nearly pure carbon (a mineral charcoal) and the ash. Where the alteration of the vegetable substance has not progressed so far, some of the volatile elements are still retained, and the coals are of the character which is defined by the word "bituminous," from the fact that they contain bitumen or pitch. Unlike anthracite, which is difficult to ignite, and burns with a clear bluish flame, the bituminous coals ignite readily and burn with a bright flame, and smoke. Those varieties of bituminous coal which are very rich in bitumen, are called "fat" coals. They soften in burning, and run down to a coke, leaving a hard, porous mass behind, which burns quietly like anthracite. Such coals are also called "coking" coals. Other varieties of bituminous coal not so rich in bituminous matter, burn without softening or cementing, and are called "dry" or free-burning. The semi-bituminous coals belong to this class. In other cases the vegetable matter has undergone so little alteration that the original structure of the plants composing it can still be detected. Such coals are known variously as lignite, peat, turf, etc.

(2799) Burning Fluid.—The illuminant referred to by this correspondent, is doubtless a mixture of oil of turpentine and alcohol, which was largely used before the days of petroleum, under the name of "burning fluid." The oil of turpentine of itself is unfit for the purpose, as it gives a very smoky flame in burning, while alcohol gives but a faint bluish flame. By mingling the two, a liquid illuminant is produced that corrects the deficiencies of both its ingredients. The proportions are about 3 parts of alcohol to 1 of spirits of turpentine. This mixture answers fully the description of our inquirer, and was generally burned in lamps of very simple character, furnished with circular wicks. It was dangerous to use, because of its great inflammability, and was rather expensive. Petroleum speedily drove it out of use.

(2800) Soda and Fustic.—Replying to this correspondent, we wish to advise him that so far as we can judge of the circumstances, the use of carbonate of soda and fustic in the manner and for the purpose suggested, will have no injurious effect. It is customary, we believe, to heat the mixture of malt and hops, or the "wort," as it is called, with live steam, prior to running it off to the fermenting vats; but even supposing that a trifling quantity of the above materials were carried over mechanically with the steam, it would be difficult to imagine that it could exert an unfavorable influence on fermentation. We are of opinion that so far as fermentation is concerned, the influence of this anti-incrustating compound may be ignored.

THE MANUFACTURER AND BUILDER.

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The Messinger Boiler Feeder.

We show in the accompanying illustrations a boiler feeder manufactured by the Messinger Boiler Feeder Co., of Boston, Mass., which combines certain novel features of construction which are claimed to give it decided advantages over other machines of its class. We have witnessed the operation of the device, and find the claims of the manufacturers, in respect to its performance and special features, to be fully justified by the test of actual practice.

Machines of the class to which the Messinger boiler feeder belongs, and which are popularly known as injectors, inspirators, etc., are deservedly held in high estimation by steam users, and have come into very general use for feeding locomotive, stationary and marine boilers. The Messinger feeder, however, differs from others of its class in possessing certain peculiarities of construction by which its capacity, range of duty and reliability are substantially increased, and by which certain difficulties hitherto supposed to be inseparably connected with this class of machines, are obviated. These peculiar features will appear from the following description. The machines heretofore manufactured have but one inlet for the water supply, so that all the water drafted is required to be cold enough to condense the steam, otherwise the apparatus ceases to operate. The utility of this class of apparatus is, therefore, limited by reason of their inability to draft hot water, and by their liability to become heated, in which latter case they refuse to operate until cooled off, giving rise to frequent annoyance and delays.

The Messinger feeder (Fig. 1) is bored perfectly straight, and by disconnecting the apparatus and removing the spindle and cap, and turning on the steam, it can be blown out perfectly clean in a moment's time, thus avoiding the serious delays which occasionally occur with machines of complex construction whenever anything is drawn into them with the water to clog them. Again, the apparatus is not affected by a variation of 25 pounds in the steam pressure. It is furnished with a pump in the supply pipe, with which the feeder can be instantly filled with cold water should it become too hot to condense the steam, thereby doing away with all delays with a heated injector. It will draft one-third of its water boiling hot through its auxiliary draft, which does not depend upon the condensation of steam for its action, and at the same time draft two-thirds of its supply as hot as will allow of the condensation of the steam. By another attachment, the feeder will draft from two or more tanks at different levels, or draft from a depth of 25 feet and take water under a head, both at the same time; and will deliver water at different levels and against widely different back pressures, both at the same time; and will feed two boilers at the same time, whether the pressure upon them varies or not, and is asserted to be the only machine of its class which has the double delivery, or that will accomplish these results.

The water from the overflow is not wasted, but is taken up by the auxiliary drafts, so that no water is wasted by the apparatus. The Messinger feeder will lift water from a depth of 25 feet below the level of the machine, and deliver it to the boiler and to tanks above the level of the machine, both at the same time, or to one or the other as may be desired. This feeder is not dependent on the steam pressure to lift its supply of water, as all other machines are that will draft at all from below their own level. A few strokes of the pump, which is part of and peculiar to this apparatus, will lift the water to the feeder, when it will draft from a depth of 25 feet with 10 pounds pressure of steam.

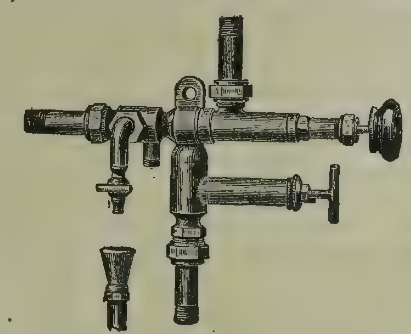

Fig. 1.—The Messinger Boiler Feeder.

The specially meritorious features of this apparatus will be appreciated when it is remembered that other machines of its class have but one inlet for water, and on this account must draft all the water cold enough to condense the steam, and are capable of but one delivery at a time.

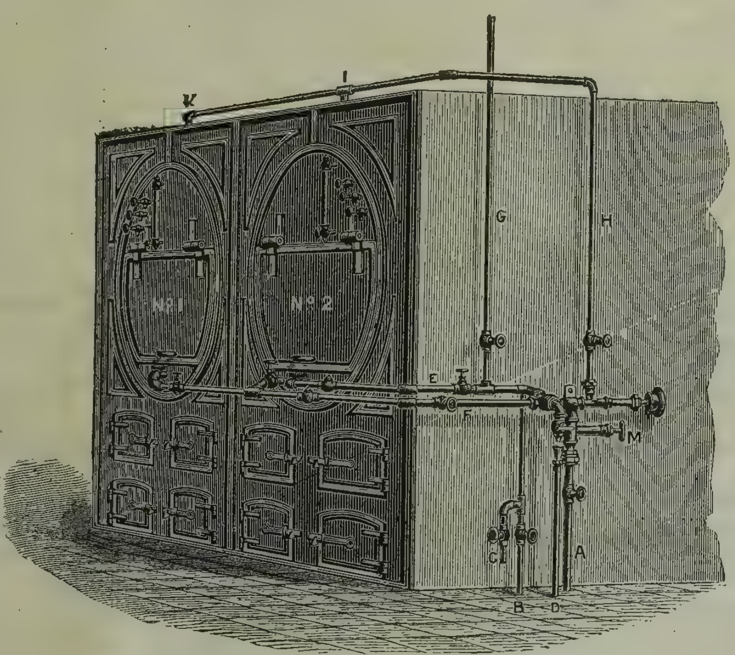

Fig. 2.—Messinger Boiler Feeder and Attachments.

Fig. 2 shows the Messinger feeder piped for all the uses of which it is capable, and will be understood from the following description: A, B and C are draft pipes. A is the main suction, and through this pipe the machine will draft water from a well or tanks 25 feet below its level, or take water under a head. B is the auxiliary draft pipe, through which the machine will draft water either cold or boiling hot, as may be desired, adding one-third to the capacity of the machine, and will also draft from a depth of 25 feet. This draft may be used or not, as desired. C is a connection in the auxiliary draft pipe B, under which a pail may be set in the boiler-room, and through which the machine will draft any liquid to be put into the boiler for the purpose of cleaning, where lime or impurities exist in the water used, or for the purpose of injecting oil to stop foaming. D is a pipe attached to a drip-cup, through which all the water from the overflow is carried back to the well, or where water is taken under a head, to the tank with which the auxiliary draft B connects, so that no water need be wasted under any circumstances. E is the auxiliary delivery, through which water may be forced to a second boiler while the machine is delivering water to another boiler through its main delivery F. G is a delivery pipe which will deliver hot water to tanks in the upper stories of a building while the machine is delivering water through its main delivery F. All the water may be delivered through either E or G, or these pipes may be used without stopping the delivery through the pipe F. H is the steam pipe for supply of steam to the machine, and through which steam may be taken from boiler No. 1 at K, boiler No. 2 at I, or from both at once. M is a pump, by which the machine may be instantly started, when any condition exists which would make other machines of this class inoperative for forcing cold water into the machine when it becomes heated, cooling the machine instantty, and is claimed to be a sure means of starting the machine to draft from a depth of 25 feet under low pressure, 10 pounds only being needed, even with the water at this great depth, to set the machine in operation.

The makers of this apparatus claim for it the following qualities and advantages: They warrant it to be absolutely reliable under all circumstances and conditions; that it is the only boiler feeder of its class that is not dependent upon the steam pressure to lift its water supply at starting, or that can be started and draft from a depth of 25 feet with 10 pounds of steam pressure; that it is the only boiler feeder that has an auxiliary attachment for drafting boiling hot water, and for increasing the capacity of the apparatus at will; that it is the only boiler feeder avoiding a heated suction pipe, and that does not waste water; that can be instantly started under all conditions, and that will feed two boilers at the same time.

Among those interested in this company, we notice the names of a number of men prominently identified with important manufacturing interests, amongst whom we find the name of Wm. P. Hunt, President of the South Boston Iron Co., and the Boston Machine Co.; and Chas. Carr, General Superintendent of the Boston Machine Co., both of whom are widely and favorably known throughout New England. The Treasurer of the company is Mr. Amos L Wood, one of the leading representatives of the mechanical arts, and who represented the State of Massachusetts in the capacity of Associate Commissioner at the Vienna Exposition in 1873.

The office of the Messinger Boiler Feeder Co. is located at 370 Atlantic avenue, Boston, Mass.

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Vol. XIII. No. 5. THIRTEENTH YEAR.

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(Illustrated articles are indicated by an asterisk (*).

Combination Against Monopoly.

We have received from the National Anti-Monopoly League, whose headquarters are in this city, a number of valuable documents and communications relating to the objects for which it has been organized. With these objects we, and we think we may safely say the great majority of our readers, are in full sympathy.

With the growth and development of the resources of the country, thoughtful men cannot repress a feeling of amazement and alarm at the prodigious growth of the corporate interest. Originating years ago, when the country was still in the infancy of its development, welcomed into existence as the means of developing our commerce and industries, and liberally endowed with rights and privileges, many of these corporations have grown from very modest beginnings, to be so rich and powerful that they have in more cases than it is pleasant to recall, forgotten that they are the servants of the people, from whom they have received their franchises. Especially of late has the growing power of corporations become a subject of very general anxiety, in view of the manifest tendency towards the consolidation of rival interests, a tendency which is especially to be dreaded since its effect is to centralize the already enormous powers and influences exercised by corporate bodies, and to concentrate in the hands of a few men, powers which, under any system of government, it is evidently unwise to permit, since, even in the hands of the best of men, they may be exercised to the vast and irreparable injury of other people.

That this distrust and anxiety are well founded, must be acknowledged by every one who is familiar with the processes of reorganization and consolidation that have of late years been going on on an enormous scale in connection with the railroads throughout the country, and which, if fully carried out in the direction towards which they are obviously drifting, will result in a few years more in the creation of three or four great trunk lines, controlled substantially by half a dozen "railway kings," to which all the other railways of the country will be merely subsidiary feeders.

What is true of the railroads, is true also of almost every form of corporation. The telegraphic business of the country is monopolized by one gigantic corporation, the production of petroleum by another, and so on *ad nauseum.* Even the influence of the press, as a corrector of the evils and abuses wrought by such alarming concentrations of wealth and power in few hands, cannot be counted on, for the money that can buy venal legislatures, can also buy newspapers—a fact of which most of our readers will be aware.

The work which the Anti-Monopoly League has set itself to accomplish is to counteract these dangerous tendencies towards centralization of power, and to limit the arbitrary, improper and dangerous exercise of power on the part of corporate institutions, by such legislation and other means as may be necessary to regulate and keep them in their rightful position as the servants, not the masters, of the people, to whom they owe their existence.

Unseen Dangers at Home.

The modern city dwelling is provided with a number of contrivances which materially add to the comfort and convenience of its occupants. We need only refer, in evidence of this statement, to the almost universal introduction of illuminating gas, of hot and cold water pipes communicating with bath-rooms and washstands in sleeping apartments, and the connection of these appurtenances and of water-closets with the sewer, through which the waste water, and that from the kitchen, and the contents of the closets, may be speedily and effectively removed without offense to the senses, and without detriment to the health. It is gravely to be questioned, however, whether these appointments—now generally deemed to be indispensable—of the modern city dwelling are unqualifiedly advantageous. There can, of course, be no question that on the whole they have greatly improved the general cleanliness of our cities, and, as a consequence, their general healthfulness, by doing away with the formerly universal practice of permitting the waste waters of the kitchen and other foul and unsavory matters to enter the sewers by way of the gutters of the streets. But, on the other hand, they frequently aggravate the many evils they are commonly supposed to check, wherever, from careless or defective construction, or other causes, they permit the gaseous emanations of the sewer—those insidious carriers of contagion and death—to gain admission into the very sleeping apartments of the occupants of the house "with every modern improvement." While the appointments, therefore, add greatly to our convenience and comfort, they may be the means of conveying the germs of contagious disease into our homes.

These facts are known to many, but they are of such vital importance, and concern all of us so directly, that they should be universally known. In view of the grave dangers that threaten the health of the dwellers in cities from the poisonous nature of the exhalations from drains and sewers, and to which the fatal character of diphtheria and other contagious diseases is known to be due, it would seem to be the hight of recklessness for any householder to neglect to inform himself at stated intervals of the condition of the plumbing and the other sanitary provisions of his dwelling. For, respecting these, it may truly be said, "Eternal vigilance is the price of safety." Nevertheless, it is no exaggeration to say that there is no subject of nearly equal importance concerning which people are so generally indifferent. Three out of four householders probably never give themselves the least concern about the condition of the pipes, traps and drains of their houses from one year to another, unless the subject is forced upon their attention by the family physician who is called in to treat a case of typhoid or diphtheria, or happily by some less serious accident.

There is little prospect that this indifference of people to that which vitally concerns their health and that of their families, can be generally eradicated without the aid of the schools where the elements of sanitary science, with especial reference to the household, should be instilled into the minds of the rising generation. The scientific and technical papers preach in vain, for their patronage is confined to the few whose eyes are already open.

Physicians with one accord agree in pronouncing typhoid fever, diphtheria and many other forms of contagious diseases which are propagated through the agency of decomposing or putrefying animal or vegetable refuse, to be *preventable* diseases; and enthusiastic sanitarians look forward to the Golden Age when the mortuary records of our cities where they now lead the list, shall know them no more, and where the occurrence of a death from typhoid or diphtheria will be looked on as a crime, demanding strict investigation, and the holding of the perpetrator to accountability.

But this happy state of things will doubtless be realized only in the distant future. In these times of general ignorance of and indifference to sanitary matters, when even a large fraction of the intelligent portion of the community still entertain the silly superstition that filth diseases are dispensations of providence, the outlook for the speedy advent of a sanitary millenium is discouraging.

Traffic of the Suez Canal.

The last report of the operations of the Suez canal, bringing up the statistical history of the company to the end of March, 1880, shows a very gratifying increase in business, and affords an additional demonstration of the wisdom of the British government in acquiring the controlling interest in this important highway to their Indian possessions.

It appears from the operations of the year above named, that 78 per cent of the foreign trade of India was carried through the Suez canal, as compared with 73 per cent during the preceding year. The number of steam vessels that passed through the canal was 1,067 in 1879–80, as against 941 in 1878–79. The tonnage of the traffic of 1879–80 rose to 1,609,769, as against 1,426,957 in 1878–79.

The internal development of India since the opening and operation of the canal has been immense, and much of it may undoubtedly be directly traced to the stimulating effect of the new commercial highway provided for the export of her products.

Discovery by Accident.

We often meet with the statement that many valuable discoveries and inventions that have advanced science and the arts were made by accident; or in other words were stumbled upon, by a happy chance. While this may be true in exceptional cases nothing could be further from the truth than the notion, that genius and intelligence played no part in these cases. Men of great learning, seeking to fathom the laws of the universe, and inventors industriously exhausting every line of experiment to accomplish their purpose, have indeed been aided by some accidental circumstance, which has perchance directed their thoughts into the right channel or suggested how a missing link might be supplied—but without the keen, searching intelligence, the accidents would have passed unheeded.

The swaying of the cathedral chandelier, had doubtless attracted the passing glance of thousands of worshippers of Galileo, but to his eye it revealed the laws of the pendulum. The accidental heating of a mixture of gum elastic and sulphur, which so happily resulted in the invention of the method of vulcanizing india-rubber, would have revealed no secret to any but to a Goodyear, with faculties on the strain to catch at anything that promised success in the task he had been laboring for years to accomplish. Accidents are not to be credited with the importance with which the exaggerations of popular writers have clothed them. They are simply the *opportunities of genius.*

Let no one delude himself with the childish notion that by aimless, haphazard tinkering, he may be lucky enough to stumble into wealth and fame. He will awake from the delusion, perhaps, too late, to find life's golden opportunities gone forever, and himself shipwrecked on the strand of disappointment. Wealth and fame are not achieved in this way. The fact that accident seems to have given the clue to some fortunate discoverer or inventor, is simply evidence of the genius of the man, not of the importance of the accident. High ambition, a determined purpose that will not be deterred by failure or adversity, and method in the pursuit of the desired object; these are the qualities that insure success.

Electric Illumination.

It is daily becoming more and more evident that the near future will decide the question of the practicability of illumination with electricity in competition with coal gas. Never was there such widespread public interest manifested in the subject as at the present time; and the rapid introduction of the electric light in public and private will give its friends and advocates such opportunities for thoroughly understanding the conditions necessary for its practical success, for enhancing the strong features, and eliminating, where it is possible, the weak ones of their respective systems, that before another year has passed, we may safely assert, we shall know whether the electric light has come to stay or whether our inventors have been seeking after an *ignis fatuus.*

Since our last editorial references to this subject, several important events have happened in relation to it, which indicate that public opinion is strongly predisposed in favor of the electric system of lighting, and that the public are determined to give inventors the amplest opportunities to demonstrate its practicability. The interesting experiment of lighting about a mile of Broadway, New York, with the Brush system of powerful electric lights, has been in progress for several months. The city of Akron, Ohio, has likewise introduced the electric light, in the form of several powerful central lights supported at a considerable altitude from the ground. And in the city of London an important trial of the electric light as a means of street illumination was begun on the evening of the 31st of March. Besides these notable circumstances, we might add the fact that the new light is being steadily introduced into hotels, manufactories, stores and large public and private buildings all over this country, and in all probability in many similar situations abroad.

Respecting the London experiments for street illumination, we may add that they promise to be highly important, as may be inferred from the following expression of their scope and of the intentions of the city authorities. From accounts that have come to us respecting these trials from local sources, we are informed that it is intended to make them both the most extensive and the most thorough of any yet undertaken. Not only will the general adaptability of the electric light for the purpose be tested, but three different systems for producing it will also be tried in competition. The systems on trial are the Brush, the Lontin and the Siemens, and to each a district of London has been assigned. The Brush Company has the Blackfriars Bridge district, the Lontin the Southwark Bridge district, and the Siemens the London Bridge district, the three districts together presenting a line of streets to be illuminated of more than two miles and a half in length. The experiments and competitive trials are to last for a year.

The specially interesting thing about these trials, is the statement which accompanies the account before us, that the bid of the Brush company was by far the lowest; that the representatives of this company, in fact, had done in London what they had previously done in New York, in regulating their prices by those charged for gas. There seems to have been so much difference between the bid of the Brush and those of the rival companies, that the fact attracted special attention. It raises at once and prominently the questions whether the figure at which the Brush company undertake to do this work, represents the cost and a fair profit to the operating company, or whether they are actually working at a loss for the sake of publicly advertising their system, with the hope of so substantially improving it during the progress of the trial as to bring the cost of its operation within reasonable limits. In the former case, which we have no right to assume is otherwise than the correct one, it would appear to be demonstrated that the Brush system is decidedly superior to that of its rivals in the highly important element of economy; while in respect to brilliancy, ease and perfection of maintenance, it is admittedly equal to the best system in use either abroad or at home. We should be highly gratified to learn that the view of the case above taken is justified, and that the Brush people are not discounting the future by making a temporary sacrifice; for if this be the case, unless they have some important improvements in reserve, or are fortunate enough to make a lucky hit, they will do the cause of electric lighting much harm and themselves irreparable injury when the concealment of their misrepresentations becomes no longer possible.

The London *Engineering*, assuming as we have done, that the Brush company have not understated the cost of operating their system in the London experiments here referred to, does not hesitate to admit that, if after a year's trial, the company can show that they are able to make a working profit out of a charge for illumination equal to that now paid for ordinary gas lighting, gas for street illumination will go, as the weakest, to the wall, and electricity, as the fittest, will survive.

While the voltaic arc system for public lighting, and great central burners for large buildings and the like, is thus rapidly approaching the period when its practical success or failure will be determined, the friends of the incandescent system of electric lighting for domestic purposes have not been idle. The indefatigable Edison announces that he has at length solved all the practical difficulties that had hitherto threatened the success of his electric lamps for the household, and has taken the field in person to superintend the work of introducing his system. He has asked, on behalf of himself and associates, for certain privileges in a limited district of New York city, wherein he proposes to make the first experimental trial of his system on a large scale. We are not advised at the time of this writing whether he has secured the concession he has applied for, but have no doubt that any reasonable request of this kind will be unhesitatingly granted by the city authorities, and the public will soon have the opportunity of satisfying themselves whether Mr. Edison's confident declarations are justified by the crucial test of practical demonstration.

As yet, we know but little of the actual value of Mr. Edison's late improvements. In a general way, they appear to have been in the direction of substantially improving the permanency of his lamp and the carbon loop, in increasing its illuminating power, and in decreasing the cost of the light. So soon as necessary details relating to these points are at hand, we shall take the opportunity of laying them before our readers. Meantime, while the Edison company are taking the necessary preliminary steps to get themselves fairly at work, the following allusion to the light that bears his name, from one of the local papers, will be read with interest:

"For several evenings past the public have had an opportunity of seeing for themselves just what sort of a light Mr. Edison has succeeded in producing. At the headquarters of the Edison company on Fifth avenue, the parlor floor of a large house is brilliantly illuminated with electric lamps of his devising. It cannot be denied by the most prejudiced owner of gas stocks that the light is beautiful and brilliant. The drawing-room is lighted by a large chandelier carrying a dozen or more lamps, and is as bright as day. A more brilliant and a steadier light could not be desired. There is none of the flicker so frequently observed in some of the electric lights, and which also characterizes gaslight; but the incandescent carbon horseshoes glow with a quiet and steady intensity. The electric current is turned on and off like gas, and the instant the electricity is let in upon the carbon it becomes brilliant. No more convenient light, therefore, could be had. No match is required to light it. It is clean, odorless, and almost without heat. The hand may be pressed against the glass bulbs, inside which the light glows, without discomfort."

To prejudge and condemn in advance of full trial, an innovation that has so many desirable qualities, on sanitary and other grounds, to recommend it to public favor, as the electric light, which has been positively done in certain quarters, is about as reasonable as to take for granted the enthusiastic claims of sanguine inventors, and proclaim on such slender authority that the success of electric lighting is assured—which has likewise been done. The near future will see the problem of electric lighting settled on its merits.

New York as a Manufacturing Center.

The investigations of Special Agent Hill of the Census Bureau, appear to establish the fact that this city is entitled to the double distinction of being not only the commercial but also the manufacturing metropolis of the country. Philadelphia has hitherto laid claim to the honor of manufacturing supremacy, but if the reports of Special Agent Hill in their present condition may be relied upon, they indicate that Philadelphia must yield the first place as a manufacturing center to this city. We give, in substantiation of this statement, the following facts and figures on Mr. Hill's authority: The returns of the census agents from Philadelphia show a total of 9,050 manufacturing establishments, with a capital of $186,686,934. They employ a maximum number of 197,964 hands, who receive wages amounting in the aggregate to $63,027,832. The value of raw material used is $202,806,644, and the total value of the product of her manufactories is $322,984,461. Incomplete as are the statistics of the work done in this city, yet it is perfectly safe to say that they will show a total value of manufactured products amounting to $400,000,000, nearly $77,000,000 more than in Philadelphia. It is estimated that the value of the product of New York's manufactories exceeds the value of her exports of domestic merchandise, coin and bullion, which amounted in 1880 to $388,441,664. It has also been in excess of the imports of merchandise for the last seven years, if we except 1880, when they increased greatly, exceeding our manufactured products by $140,000,000.

Improved Scroll Saws and Lathes.

Since the first introduction of the art of scroll or fret sawing into this country from Switzerland, some years ago, it has grown into great popularity. It is now very widely known and practiced not only as a fascinating recreation for those of mechanical and artistic taste, but as a useful and profitable occupation. As an outcome of the popularity which this very attractive art speedily obtained, the earlier scroll saws have been very materially improved. The old clumsy wooden frame machine has made way for the neat and tasty iron frame, and the mechanical ingenuity of American makers has developed the simple scroll saw into the more useful combination of scroll saw and lathe. The capabilities of these machines in expert hands, and the exceeding beauty and novelty of the effects that can be produced with them, are facts well known to most of our readers. They afford an exhaustless fund of pleasant recreation and artistic gratification to the elders of the household, enabling them to decorate their homes with those articles combining beauty with utility with which we are all familiar; while they provide an admirable and fascinating means of gratifying and developing the mechanical tastes of the young. To those possessing at once mechanical talent and good taste, the scroll saw may afford, besides a pleasant occupation, the means of a livelihood.

We illustrate in the accompanying cuts two excellent machines of this class, manufactured by A. H. Shipman, of Rochester, N. Y., who has devoted himself for a number of years to this special branch of manufacture. He has introduced many and important improvements which have been added from time to time, and which have decidedly increased their utility.

The "Prize Holly" scroll saw is illustrated in Fig. 1. It is manufactured in several forms, all, however, similar in construction, to meet the requirements of the several classes of workers—the beginner, the more advanced scroll sawyer, and the expert. These several machines vary in price and in their capacity for executing work.

This machine is especially constructed so that it can be used for a practical lathe, a feature that materially adds to its utility. The saw attachment can be removed from the lathe bed, by loosening a single screw which holds it in position, and the lathe attachments substituted in its place in a few seconds. Purchasers have the option of taking the saw only, or the lathe only if they are so disposed, or of taking both combined. The machine, while it is excellently adapted to the requirements of young beginners, is capable of turning out first-class work.

Fig. 1.—"PRIZE HOLLY" SCROLL SAW.

Fig. 2.—"PRIZE DEMAS" LATHE AND SCROLL SAW.

The following are the figures of dimensions and capacity for work: Hight of machine, 30 inches; full width, 18 inches; diameter of balance wheel, 12 inches; weight, 7 pounds. The scroll saw will cut $1\frac{1}{2}$ inches thick and swing 20 inches in the clear; stroke, $1\frac{1}{2}$ inches; the very finest or coarsest blade can be used with it. The lathe will turn 10 inches long and 4 inches in diameter. Small chucks for holding drills, etc., can be fitted to the spindle if desired. The lathe-bed ways are ground and polished, which gives a smooth and level surface for head and tail block to travel on. The tilting table for inlaid work on the scroll saw, is also ground and polished. The full weight of the machine is 30 pounds. These machines are sold, according to the number of accessory tools and designs accompanying them, at prices varying from \$3 to \$6.50.

The "Prize Demas" scroll saw and lathe, shown in Fig. 2, has the following dimensions and capacity: Hight from floor to top of lathe bed, $27\frac{1}{2}$ inches; to centers, 30 inches; to top of saw table, 32 inches; length of lathe bed, $24\frac{1}{2}$ inches; it will turn a piece 16 inches long and 5 inches in diameter; diameter of balance wheel, 14 inches; weight, 11 pounds; stroke of crank, 4 inches; size of lathe spindle, $^{7}/_{16}$ inch; short rest, 4 inches long; long rest, 12 inches long. Stroke of scroll saw, $1\frac{3}{4}$ inches; it will cut $1\frac{1}{2}$ inches thick if necessary, but 1 inch practically, and swing 20 inches in the clear; it has a tilting table, which is ground and polished, as are also the ways to lathe bed. Chucks for holding drills, etc., can be attached. Weight, 50 pounds. The price of this machine will vary, according to character and number of accessories, from \$6 to \$9. It presents a very symmetrical and tasteful appearance, and is very substantially constructed.

The utility of both of these machines for executing the most intricate patterns in fret sawing cannot be excelled. The manufacturer has fully appreciated the wants of amateur mechanics, and has prepared an excellent manual of instruction, with plenty of illustrations, relating to fret sawing and turning in wood; fret sawing in metals, shell, pearl and ivory; a manual of the turning lathe; descriptions of tools for wood-carving, with instructions how to use them, and other matters of great interest and value to those desirous of turning their attention to this class of work. The illustrations and descriptive matter relating to fret sawing and turning will be found especially useful.

Cement for Rubber.

Powdered shellac is softened in ten times its weight of strong water of ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. As soon as the ammonia evaporates, the rubber hardens again—it is said quite firmly—and thus becomes impervious both to gases and liquids. For cementing sheet rubber, or rubber material in any shape, to metal, glass and other smooth surfaces, the cement is highly recommended.

Rendle's Systems of Glass Roofing.

We represent in the accompanying engravings an improvement in glass roofing, which has been very extensively adopted in England. Fig. 1 shows the improved system ordinarily applied. By this plan the glass is held in place by means of metal plates bent into S shape, forming a groove in which the glass rests. This plan is seen in section in the small figure on the left of Fig. 1. These metal plates are attached by means of screws to purlins or bearers, and the lower edge of the glass rests against their upturned portions of the plates. For long bearings, angle iron purlins are used instead of wood. In putting the glass in place, the plates are cut so that by shoving their upper edges as far as they will go into the top bar, their bottom edges will clear the clips or upturned portions of the lower bars, when they fall into place and are securely retained by the clips. Where the sides of the plates join, they are lapped to the extent of an inch or an inch and a half. The metal bars holding the glass are provided with openings, which provides a free passage for water or condensed vapor, which runs down into the grooves and escapes through the holes. The metal bars or plates are made in 3-foot lengths of either zinc or copper, and are attached to the purlins with brass screws. E, Fig. 1, shows the method followed in forming the ridge, by fixing a zinc roll to the ridge piece with a flange sufficiently long to overlap the top bar. By this system the iron and wood work are entirely covment is required to make the joints water-tight, the construction being such that all water, whether from outside or from condensed steam on the inside, is car-

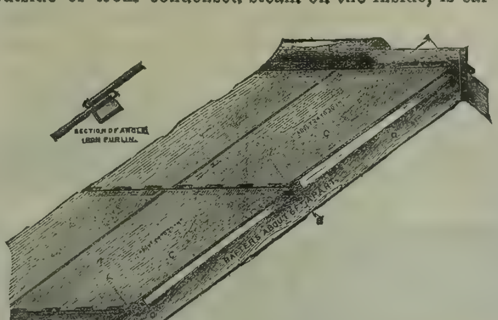


Fig. 1.—Ordinary System.

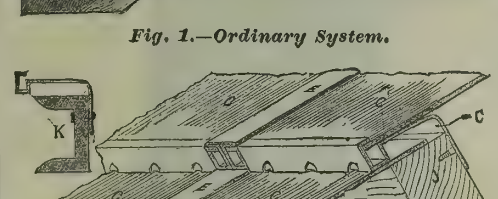


Fig. 2.—Rendle's System of Glazing.

ried to the outside, and so off the roof. This system of construction is remarkably strong; is very economiings. Our engraving, Fig. 3, shows a view of one of the most important of these—namely, Sir. J. Whitworth & Co.'s gun factory at Openshaw, near Manchester, containing 116,000 square feet of glazing. This system has also been applied to the numerous shops of the Woolwich Arsenal, the Royal Aquarium, Westminster (60,000 square feet), the Blackpool Winter Gardens (80,000 sq. ft.), the Carlisle Citadel station, Caledonian Railway (322,000 sq. ft.), the Gordon street station, Glasgow (130,000 sq. ft.), and the City of Glasgow Union Railway's Bridge street station (100,000 sq. ft.)

Fig. 2 represents a modification of the method above described, known as the "Acme" system, which is intended for flatter roofs—say 15 to 20 degrees. The form of the metal plates making the grooves is shown at C. Instead of being lapped, the glass plates are butted together with a T-shaped metal strip E between them. Double channels are provided beneath the glass plates for carrying off water blown in from outside or condensed moisture from inside. K shows the method of adapting the plan to iron purlins.

The above systems of glass roof construction are being introduced into this country by Mr. Arthur E. Rendle, whose office is at No. 7 Warren street, New York. Already, we are informed, a number of important orders have been received, among others the New York Central & Hudson River Railroad Co. have decided to adopt the Rendle systems for the new portion of their Buffalo depot (460 by 30 feet). The Flint & Pere Marquette Railroad Co. have likewise ordered a

GUN FACTORY AT OPENSHAW, ENGLAND, COVERED WITH RENDLE'S GLASS ROOFING.

ered by the metal and glass, and are thus protected from the action of the atmosphere; the glass is free to move in the metal grooves, and, having plenty of play, there is no danger of breakage by reason of contraction and expansion from cold and heat; should it be necessary to remove a plate, this can be done without disturbing any of the others; no paint, putty or cecal, both in first cost and in saving in maintenance and repairs, and is free from the danger of breakage from vibration caused by high winds or the passage of railway trains, or the movement of heavy machinery.

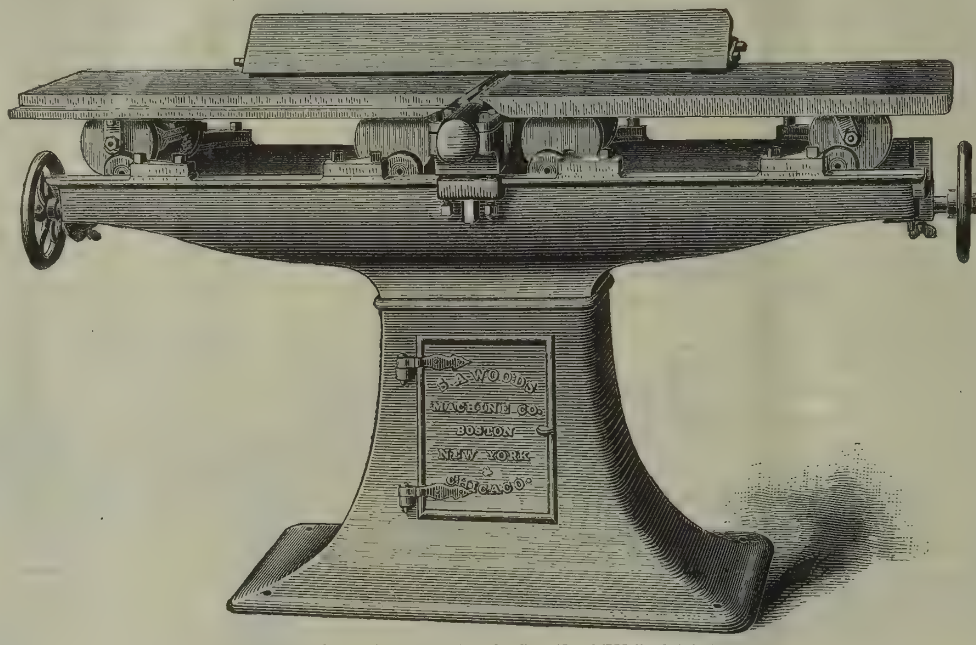
This system has received extensive adoption in Great Britain and Ireland, a list before us embracing a great number of important public and private buildskylight for their new machine-shop at East Saginaw, Mich., 280 feet long; and numerous inquiries from other important sources have been received. We are informed by the manufacturer that there are over 4,000,000 square feet of his glazed roofing in use in England.

Mr. Rendle has offices also at 80–82 Adams street, Chicago, and at 94 King street (East), Toronto, Canada.

Improved Jointing and Facing Machine.

This engraving illustrates a hand-planing machine newly designed by the S. A. Woods Machine Co., to which the makers invite the attention of wood-workers. The base of the machine being cast in a single piece (in pedestal form), combines a neat appearance with great strength and solidity, and provides a handy, tight-closing receptacle for wrenches, tools, etc. The frame being a single piece, and resting firmly on the base, prevents all possibility of twisting or straining moving parts. Each table is adjusted by a single screw, and is so hinged as to move concentric with the path of the cutters. The adjustment is such that the movements of the table can be controlled to a nicety, and will remain rigid wherever left. The tables can be brought very near together, making a narrow opening, which is essential to good work and the safety of the operator. They are readily drawn back, allowing easy access to sharpen or adjust the cutters. A solid forged head, with long bearings running in improved boxes, adds much to its durability. The table is fitted for rabbeting. The gauge adjusts to any bevel, and also swings diagonally across the cutters if desired. The machine is built with the customary care which these makers are known to bestow on their work, which, combined with its really desirable features, makes it a superior machine. A counter-shaft is furnished with each machine, with 10 × 4 tight and loose, and 24-inch driver, and should make 650 revolutions per minute, giving the cutter-head 4,500. The table is made 5 or 7 feet long, to plane 8, 12, 16 and 24 inches wide.

The manufacturers are the S. A. Woods Machine Co., of 91 Liberty street, New York, and 172 High street, Boston.



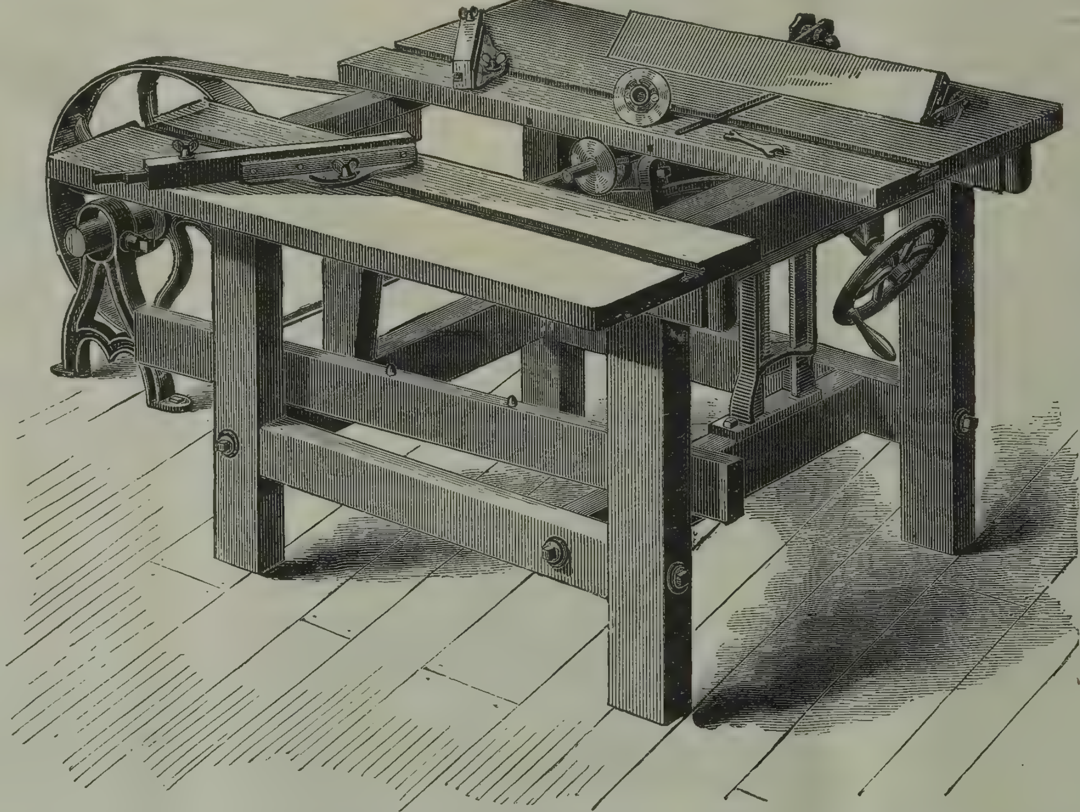
IMPROVED JOINTING AND FACING MACHINE.

BIRCH FOR CABINET-WORK.—The small value of birch wood for fuel, and its lack of toughness and strength, except in the smaller twigs, have led to its general neglect in the arts. Our more enterprising builders of railway cars, however, have discovered that its light weight, close grain and rich finish make it admirably suited for certain applications where fine finish and bright effects are desired. The contrasts presented when white birch and light colored ash are relieved by the red of the cherry birch, are said to be peculiar but very pleasing.

STEAM JOINTS.—When rubber plates and rings are used for making connections between steam and other pipes, leakage of joints may be prevented by using a cement prepared by dissolving shellac in ammonia. The pulverized gum shellac is soaked in ten times its weight of strong ammonia, when a slimy mass is obtained, which in three or four weeks will become liquid without the use of hot water. This fastens well both to the rubber and to the metal or wood, and becomes, by volatilization of the ammonia, hard and impermeable to either gases or liquids.

Improved Adjustable Saw Table.

The accompanying engraving represents a saw-table manufactured by the S. A. Woods Machine Company, well known throughout the country for the excellence of their numerous special wood-working machines.



IMPROVED ADJUSTABLE SAW TABLE.

This saw-table is claimed to possess a number of features which entitle it to be considered as the best and most convenient in the market. The frame is made of iron or wood, as desired. When made of wood, the best kiln-dried lumber is used. The top is glued up from rock-maple strips, and the arbor is of the best cast steel, running in self-oiling boxes of improved construction and fitted with an improved self-centering bushing, whereby saws with holes of different sizes are automatically centered. The arbor, with its swinging frame, is raised or lowered to any required position by means of the hand-wheel and screw, giving every facility for the use of grooving or dado heads without possibility of a change of position when once set. An improved splitting gauge is supplied, which can be set to cut any angle to 45°, while the two cross-cut slides allow stuff to be mitered or worked on either side of the saw at any angle.

The top is made in two parts, one of which can be drawn out, as shown in the cut, when a larger top is required, or when using special heads or saws; while for ordinary use, it can be closed in, to occupy less room. Suitable appliances retain this movable top in place in any position.

A counter-shaft is provided with each table without extra charge, with 12 × 6 tight and loose, and 24 × 6 driving pulley, and should make from 400 to 500 revolutions per minute, giving the saw from 2,400 to 3,000. Size of top when closed, $4\frac{1}{2}$ by $3\frac{1}{4}$ feet; when extended, $4\frac{1}{2}$ by $4\frac{3}{4}$ feet. Diameter of arbor, $1\frac{1}{4}$ inches for holes in saw, from 1 to $1\frac{3}{8}$ inches.

The makers, the S. A. Woods Machine Co., can be addressed at 91 Liberty street, New York, or 172 High street, Boston.

Electric Lifts.

Dr. Werner Siemens has made another useful application of the dynamo-electric current to the performance of mechanical work, by the invention of an ingenious electric lift, which was recently exhibited at the Mannheim Industrial Exhibition, where, in the course of a few weeks, it conveyed over 8,000 persons at a speed of $1\frac{1}{2}$ feet per second. The lift is quite safe, the carriage being suspended by two wire ropes which pass over drums at the upper terminus and carry counter-weights at their ends which equilibriate the average burden to be borne. To raise or lower the lift, therefore, only slightly additional power is required. This is supplied in the form of an electric current from a dynamo-electric generator on the ground, and it is conducted to a second dynamo machine attached to the carriage. The propulsion is effected by means of a metal ladder or rack which runs up the middle of the shaft or passage of the lift, and into this rack work two toothed wheels carried by the lower part of the framework of the carriage. These wheels are driven by the revolving armatures of the dynamo machine on the car by an endless screw. The current is led from the stationary generator to the moving one by conduc-

tors running up the sides of the ladder, and two metal rollers which make contact with them and are connected to the armature of the machine. The return part of the circuit is formed by the metal wires which haul the carriage. In hotels and such places, for the conveyance of persons and luggage, this electric lift is likely to be useful; but for mercantile purposes it would be advisable, perhaps, to modify it, and replace the ladder arrangement by a wire rope and driven by the current.

Combined Worthington Pump and Boiler.

We show in the annexed engraving a combination of the well-known Worthington steam pump with an approved form of portable boiler, for which the manufacturers claim a number of desirable advantages, the most notable of which we enumerate in what follows: The boiler base and bracket on which the pump rests are made in one, and in such a manner as to secure proper strength with the minimum of weight. The boiler is provided with a shaking grate, so constructed as to permit of the dumping of the fire when necessary, without opening the fire door. To control the draft more effectually, the ash-pit door is provided with a sliding plate. The attachment of a two-way cock on the exhaust pipe is claimed to secure an important improvement, since by simply turning this the steam may either be discharged directly into the open air, or into the chimney should it be desirable to force the draft.

The apparatus is furnished by the makers complete, with auxiliary feed, boiler base, smoke bonnet, shaking and dumping grate, water column (to determine the hight of water in the boiler with greater certainty), gauge glass, gauge cocks, steam gauge, safety valve, globe valves, two-way exhaust cock, blow-off cocks, steam and exhaust pipes, boiler-feed connections, and all other necessary fittings.

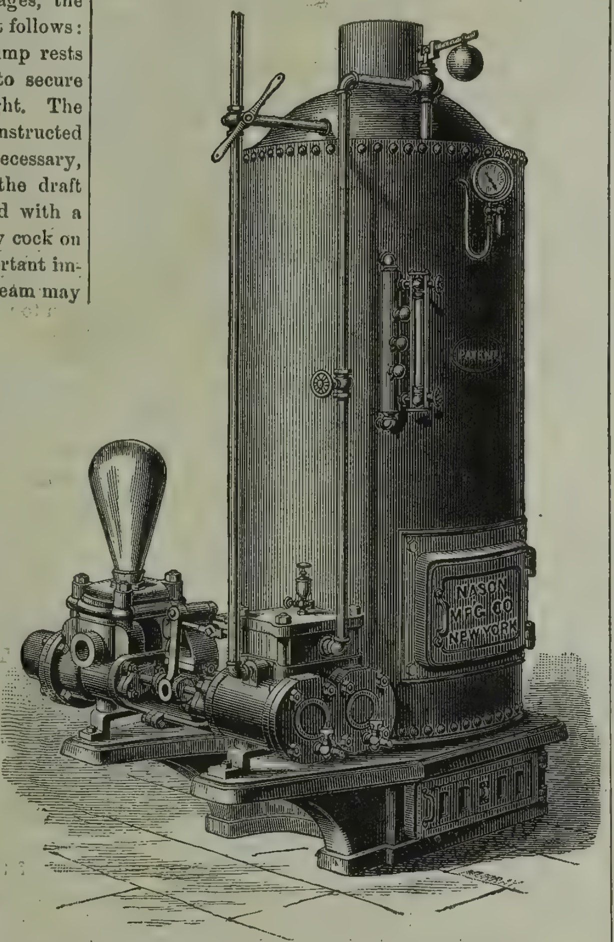
Respecting the Worthington pump, our readers desiring special information respecting its construction and action, are referred to the back volumes of the MANUFACTURER AND BUILDER, in which several very complete descriptions of its mechanism may be found. In this place we will simply add, that the valve motion is its prominent and important peculiarity, to which it owes its exemption from noise and concussive action. Two steam pumps are placed side by side (see engraving), and so combined as to act reciprocally upon each other's steam valves. The one piston acts to give steam to the other, after which it finishes its own stroke and waits for its valve to be acted on before it can renew its motion. This feature allows all the water valves to seat quietly, and removes everything like harshness of motion. As one or the other of the steam valves must be always open, there can be no dead point. The pump is, therefore, always ready to start when steam is admitted, and is managed by the simple opening and shutting of a valve.

In the arrangement of the Worthington steam pump, special care has been taken to have all the parts easily accessible for inspection or repairs. All the moving pieces being made to gauge, can be readily renewed. The successful application of a pump depends much upon its proper selection from among many patterns differing greatly from each other in size, proportion, material, and general arrangement. The manufacturers, therefore, request those ordering pumps to state the nature of the service for which it is intended, the quality of the liquid to be pumped, and whether cold or hot, the hight to which water is to be lifted by suction and the length of the suction pipe, the hight to which water is to be pumped, the maximum quantity of water needed per hour, steam pressure used, and other necessary details.

The engraving shown herewith gives an excellent view of the steam pump and boiler here described.

Circulars embodying special information respecting dimensions, capacity, cost, etc., may be had on application to the manufacturers, the Henry R. Worthington Hydraulic Works, 239 Broadway, New York.

EFFECT OF AGE UPON THE STRENGTH OF IRON.—Prof. Bauschinger has lately tested some iron taken from a chain bridge built in 1829, and found that after fifty years of service its strength and elasticity had not altered perceptibly from what they were reported to be at the time they were put to service. The fact that age has little effect on the quality of iron is likewise verified by the result of tests made by Prof. Thurston of pieces of wire cable of the historic Fairmount suspension bridge at Philadelphia, lately taken down after forty years of service. The tested pieces were found

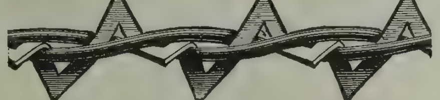


COMBINED PUMP AND BOILER.

to have a tenacity, elasticity, and ductility fully equal to the best wire of the same size found in the market to-day.

The Champion Barbed Wire.

One of the most practical and thoroughly American improvements of late years, has been the introduction of barbed wire for fencing as a substitute for the common and generally very crude and imperfect forms of fencing hitherto almost universally used throughout



"Champion" Barbed Wire.

the country. The latter are, with rare exceptions, not only very unsightly to look upon, but, unless constantly looked after and kept in repair, afford but poor protection for an enclosed field against the destructive inroads of cattle, swine and other depredators.

Barbed wire fencing, though a comparatively recent innovation, is so decided an improvement, that its merits were at once appreciated, and in numerous forms and modifications has been extensively introduced all over the country. It is strong and permanent, doing away with the necessity of constant vigilance to keep in repair, which is so troublesome a feature with all forms of wooden fencing; it is sightly and even attractive in appearance, an advantage that will be appreciated by all who take pride in having the surroundings of their farms and country houses neat and tasteful; and what is of still more importance, it fulfills the requirements of a fencing in respect to being an efficient protection to the enclosure which it surrounds—more effectively and securely than any other form of fencing that has yet been devised. These merits will be best understood and valued by those who have had some experience of the constant vexation and annoyance of keeping wooden fencing in proper condition to withstand the destructive inroads of cattle, swine and other depredators into growing grain fields or gardens, which, in spite of the utmost vigilance, are often the scene of sad havoc.

Among the various forms of barbed wire in the market, is the "Champion," manufactured by the Hazard Manufacturing Co., of 87 Liberty street, New York, which is a wide departure from other barbed wires, being made on an entirely new plan. We illustrate above a section of this wire, which shows its construction so plainly as to make a detailed description unnecessary. It is strong and substantial, is sufficiently formidable to make it effectively cattle-proof, and makes a neat and tasteful appearance. The manufacturers will be pleased to furnish descriptive circulars and other desirable information on application.

Space Around Steamboat Boilers.

A circular from the United States Treasury Department, containing official copies of the Steamboat Rules and Regulations, was read at the annual meeting of the Board of Supervising Inspectors. The principal change is in Rule No. 10, applicable to all steamers hereafter built, which now reads as follows: "All steamers navigating rivers, having boilers externally heated, shall have a clear space of not less than 6 inches between the boilers and wood-work on either side, and 4 inches on the top of said boilers. All steamers navigating the ocean, sounds, lakes, bays and rivers, the boilers of which shall be internally heated, shall have a clear space of at least 4 inches on either side, and at the top not less than 2 inches clear space above the covering of the boilers. All wood-work or other ignitable substance approaching within 2 inches of the boiler, shall be suitably sheathed with metal, so adjusted as to permit a free circulation of air between the sheathing and ignitable surface. All boilers shall have a clear space at the back and ends thereof of 2 feet opposite the back-connection door."

It is to be observed, in the language of the Solicitor of the Treasury, "that there is nothing in the rule which forbids the local board from requiring more space than that mentioned, if in its judgment it may, in any case, be necessary to require it." Practically, therefore, the amended Rule 10, instead of prescribing the exact space which shall be allowed between the boiler and the wood-work adjacent, leaves this question to the several local boards in the exercise of their free judgment.

THE BASIC PROCESS FOR THE DEPHORISATION OF IRON, which has occupied of late so much of the attention of metallurgists, is reported to have been purchased by what is known as the Bessemer Association, which carries with it the Thomas and Snelus patents for the United States, and all the rights and privileges owned by Mr. Thomas and his associates, so far as they relate to this country. The basic process, it may be remembered, is a method which has solved the problem of making merchantable steel by the Bessemer process from phosphoretic irons, and has, therefore, very materially extended the utility of the Bessemer process. Its practicability has been amply demonstrated abroad, where it is now in successful operation, and we may soon expect to see it in operation here.

The Standard Hydraulic Elevator.

To one who was familiar with the aspect presented by the business quarters of our leading cities a quarter of a century ago, the most remarkable change that he would notice to-day would doubtless be the very general increase in the hight of the buildings as compared with what they used to be. The tendency to the erection of very tall buildings, which is everywhere noticeable in the business quarters of most our cities, is due partly to the steadily increasing value of land—which in certain favored localities commands almost incredible figures—and partly to the steady tendency of business to concentrate itself to certain limited localities. The inconveniences attending access to the upper stories of such inordinately tall buildings as one sees everywhere in our business thoroughfares, would undoubtedly have greatly limited their number, and from the necessities of the case would have forced a lateral instead of a vertical extension of our business quarters, had not the substantial improvement of passenger elevators done away with the serious loss of time and the severe labor which the mounting of interminable flights of stairs formerly entailed. With these improved appliances, safe, rapid and convenient access to the upper floors of the tallest buildings is afforded, and their introduction served the double purpose of removing the previously existing objections to towering buildings and of materially increasing the value of the upper floors.

The earliest passenger elevators were simply modifications of factory elevators, or hoists, and the fact that their ropes sometimes parted and let the cage and its contents down with a run, did not add materially to their popularity. The necessities of the case, however, called forth the best efforts of inventors, and the result to-day is that we possess a system of elevating passengers which as nearly realizes the conditions of perfect safety as such a condition of things is possible in practice; and the knowledge of this fact has completely eradicated earlier prejudices and the lack of confidence. The first steps in the improvement of the passenger elevator involved the introduction of safety attachments in the form of extra ropes, and then later of ingenious clutches and catches, generally dependent for their action upon butting, jamming or twisting friction to hold the cage and prevent its rapid descent in the event of an accident. These devices by materially lessening the risk, established a certain amount of confidence in the public mind in the use of these machines, and may be said to have fairly inaugurated the era of the passenger elevator, in which, as now improved, we have an apparatus that fully meets every reasonable requirement such an apparatus should fulfill as regards safety of ascent and descent, rapidity, and smoothness of action. As a consequence, the introduction of these appliances has gone hand in hand with the skyward extension of business houses, until to-day in our leading cities no large building is considered finished unless supplied with these convenient aids for gaining access to its upper stories.

The substantial improvements that the necessities of the passenger service have brought about in this class of machinery, has at the same time had an excellent effect in doing away largely with the old and dangerous hoists in factories and warehouses, and the substitution in place of them of safer and more reliable appliances, with the result of greatly lessening the loss of life and limb which in former years were common occurrences.

For the present perfection of the passenger elevator, we are largely indebted to the persistence and mechanical skill of the firm of Messrs. Otis Brothers & Co., of New York, who have been identified with the business from the time of its origin to the present, and whose Standard Hydraulic Elevator has gained by its merits a larger measure of popular favor than any other of its class. We present upon the annexed sheet a number of illustrations representative of the manufactures of the Messrs. Otis Bros. & Co., together with views of several characteristic and well-known buildings in New York in which their elevators have been in daily service since their erection. These buildings are respectively the Boreel Building, the Morse Building, and the Post Office. In the last mentioned building they were substituted for the old telescope elevators, which were removed after having proved complete failures. The two first buildings are among the largest and best appointed in New York, and are used principally by banks, insurance companies, and private business offices. Among other conspicuous buildings in this city where these elevators are employed, we may mention the Liverpool & London & Globe Insurance building, and United Bank building.

Referring to our full-page illustration, there is shown a perspective view of the factory of the Otis Brothers & Co., at Yonkers, N. Y., which occupies a space of 200 feet square, and which contains within itself all the necessary facilities for the manufacture of hoisting machinery of every description. The thirty years' experience of these manufacturers has enabled them to introduce a thorough system in all the details of the several departments of their works, a fact which explains the reliability and uniform excellence of the machinery they turn out. The variety of work called for in the manufactures of the Messrs. Otis Bros. & Co. is very considerable, a fact which will be best understood by our mechanical readers from the statement that they manufacture, in addition to a great variety of hydraulic and steam elevators for hotels, public and private buildings, likewise numerous forms of elevators and lifts for warehouses, factories, furnaces, mines, winding engines for inclined planes, screw and gear combination lifting powers, and many special modifications of engines and appliances to meet the requirements of all kinds of service.

The greatest accuracy in workmanship is sought for in the construction of these machines. Each piece in every machine is made an exact duplicate of the corresponding piece in similar machines, so that in the event that any particular piece of a machine in service requires to be replaced by reason of wear or injury, it can be at once duplicated without delay. All the pipes and cylinders used in these machines are first subjected to severe hydraulic pressure in the testing department before they are sent out, the pressure applied being many times greater than they will ever be called upon to bear in service. The gates and valves likewise are carefully fitted, to observe if they work smoothly and with precision. Attention to such details affords one of the best evidences of careful workmanship, and will go far to account for the thorough adaptation of parts, careful adjustment, and uniform excellence which characterize the machinery of this establishment.

In our full-page illustration, already referred to, views of one of the ten erecting shops, and of the testing department of the works are also shown. On the next page are given a section exhibiting the mechanism of the elevator and a view of the interior of one of the passenger elevators.

The action of the Standard Hydraulic Elevator will be readily understood from the following description: The carriage is suspended from four or six wire ropes passing over a fixed pulley above the highest point of the lift, and from that around a movable pulley connected with the piston rod of the upright cylinder, seen in the sectional cut. In connection with this is also a weighted block, which, together with the piston, constitutes a counterpoise for the carriage. The ends of the wire ropes are permanently attached at a point as high as the fixed pulley. The motive power for the operation of this elevator is obtained by using the pressure and weight of water from a tank in the upper story of the building, or directly from the city mains, as may be most convenient. In addition to this pressure and weight upon the top of the piston, the pressure of the atmosphere is utilized below it. These forces are applied to raise the carriage by drawing the water from the cylinder below the piston. The carriage, it will be remembered, is secured to the piston by the wire ropes. When the carriage is at the lowest point of its course, the piston is at the upper end of the cylinder. To cause the carriage to rise, the valve rope passing through it (and shown in the hands of the figure) is pulled, thus opening a valve which admits water through a pipe to the top of the piston, and at the same time opens an exit pipe for the water already in the cylinder below the piston. Since the weight of the carriage itself is compensated for by the counterpoise already mentioned, the resistance to be overcome reduces itself to the load added, *plus* the inertia of the various parts. Against this, we have, first, the weight of the air—15 pounds per square inch—above the piston. This is obviously gained through the escape of the water below, the cylinder being always full. Second, the absolute weight or pressure of the water itself acting on said piston, which pressure may exist in city mains or may be due to a difference of level between the bottom of the cylinder and a tank located in the upper story of the building. The result of this condition is necessarily the descent of the piston and the elevation of the carriage, the water below the piston meanwhile escaping into the sewer, or being led into a tank, from which it may be raised by any means to the tank in the upper story, and so be used over again.

To lower the carriage, no outside power is called into use. The valve rope is pulled so as to set the valve in the opposite direction, and thus allow one column to balance the other, and the water above the piston to pass out of the cylinder through a circulating pipe and back into it again under the piston, the piston itself ascending in the meantime, being moved by the greater weight of the carriage. The carriage thus sinks noiselessly and smoothly, its speed regulated by the operator in the opening or closing of the valve, and outside of his control by the size of the pipe. Any speed desired may be obtained, and a certain range is allowed the operator; but each machine is so set that the maximum speed desired by the proprietor cannot be exceeded. It stops automatically at the top and bottom, and may be called from one floor to another by pulling the operating rope at the door where it is wanted. The cylinder is made of cast iron, and is bored out true and smooth its whole length. All moving shafts are of steel; all other parts, except the car, are of iron.

Where the city pressure is used, no engineer or skilled attendant is needed, but any one who will oil the bearings can operate it.

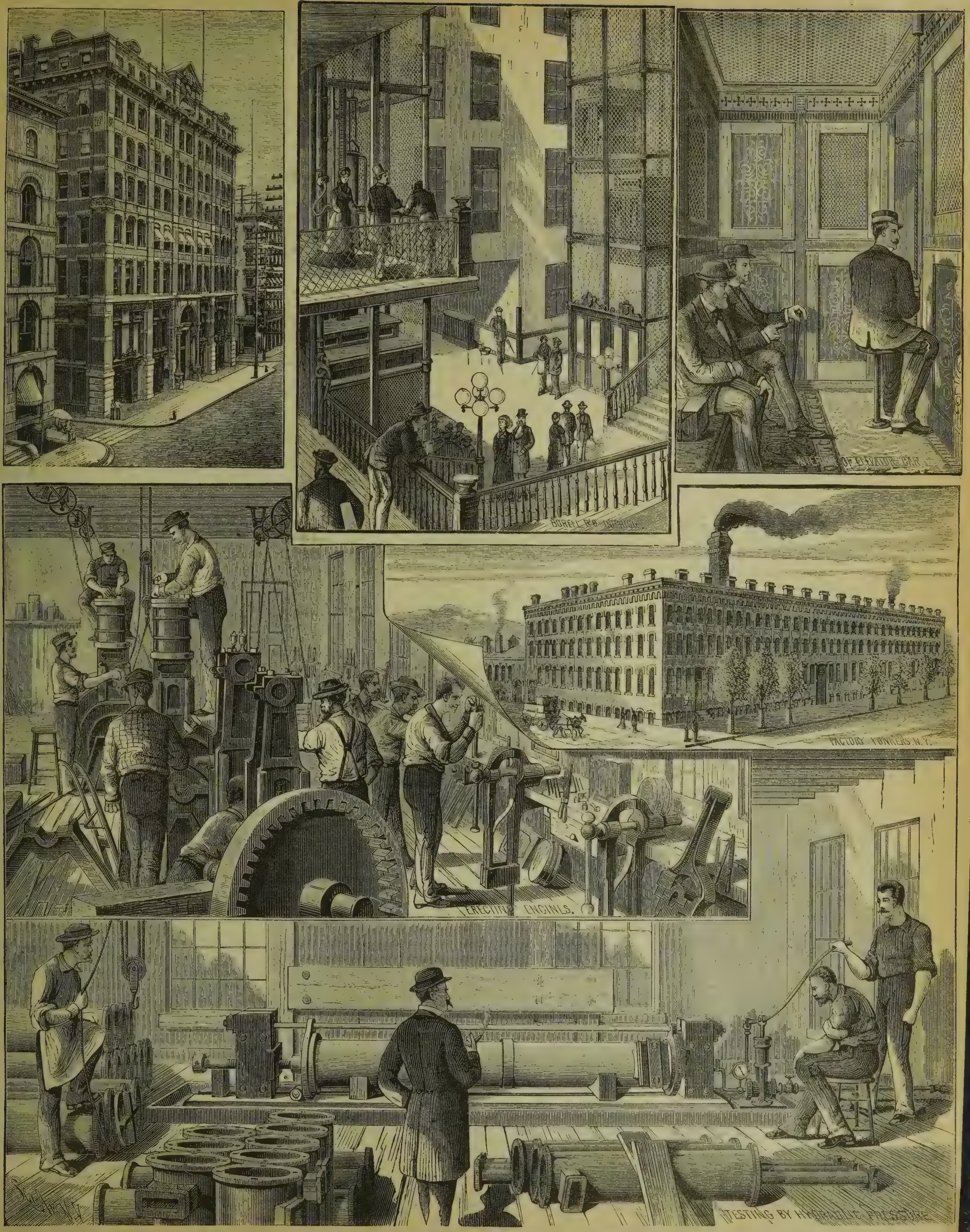
The manufacturers make passenger and freight machines of this style for any required loads. The air pressure and the weight of a column of water of the diameter of the cylinder, and as high as the tank on the roof, or its equivalent in the head from which it is supplied, is exerted in lifting the load. The cost of operating these elevators is dependent upon the water pressure, load, hight, number of trips, and the price of water when connection is made with city mains (which varies in different cities). Where water must be pumped, one ton of coal per week is estimated as the average consumption for running one of the elevators as ordinarily used. Where several elevators are used, the coal consumption can be reduced to one and a half tons for two. The same makers manufacture a double power elevator, using the same principle of action.

One of the most satisfactory evidences of the meritorious features of these machines, is afforded by the report of the government experts who recommended their adoption in the Chicago government buildings.

These elevators are in use in most of the leading cities of this country, and in many of the most prominent buildings, and the high reputation they have gained for simplicity of construction, economy of operation, durability in service, and perfect safety, will doubtless contribute to a still greater and more general introduction in the near future.

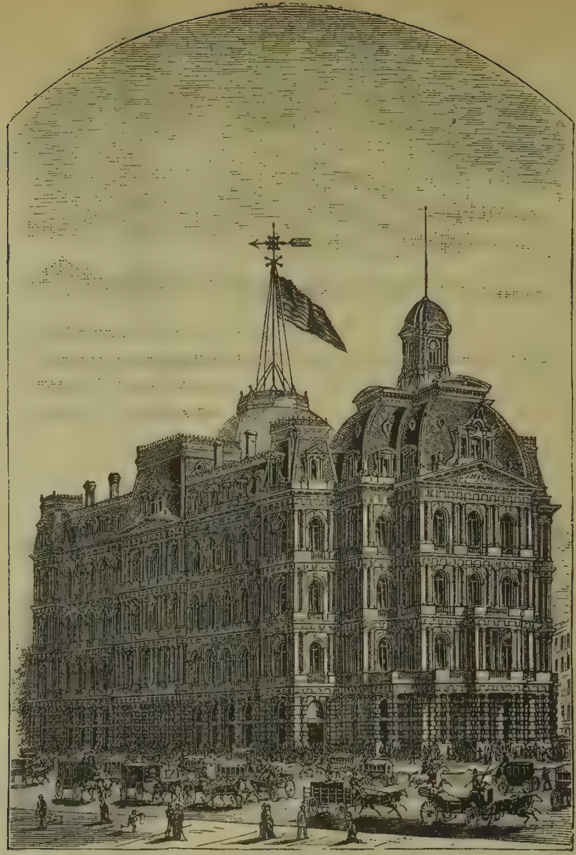
The address of the manufacturers is, Otis Brothers & Co., 348 Broadway, New York.

SOME OF OUR BEST ARTISTS are of Hebrew origin, but in ancient times this race was very deficient both in artistic taste and constructive skill.

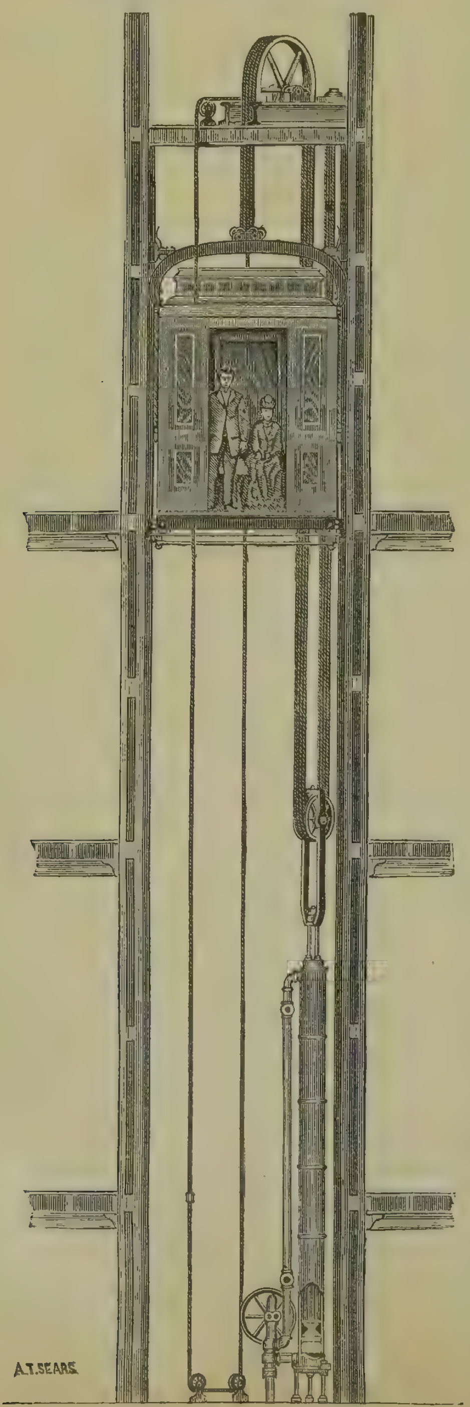


Manufacture of Hydraulic and Steam Safety Hoisting Machinery—Otis Brothers & Co., 348 Broadway, New York.

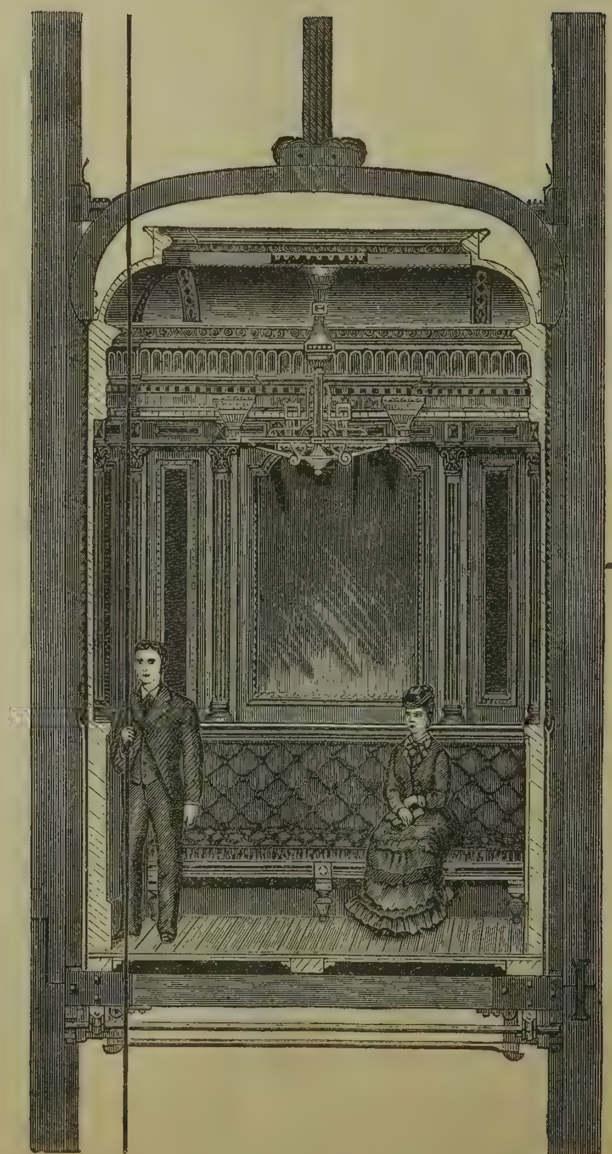
MORSE BUILDING.



NEW YORK POST OFFICE.



SECTION OF ELEVATOR.



OTIS HOTEL ELEVATOR.

The Jarvis Furnace.

In our issue of last month, we invited the attention of our readers, in a brief article, to the wastefulness which characterizes the generation and use of steam as a motive power. It may not be amiss to refer in this place to certain of the conclusions presented therein, since they have a very direct bearing on the subject of the present article.

In tracing the causes of the loss of power in connection with the generation of steam, we noticed, as among the chief elements partly, the difficulty of burning solid fuel economically; again, the fact that the combustion products could not be maintained long enough in contact with the steam generating surfaces to yield up all of their available heat; and chiefly the fact that combustion is generally so imperfect that great quantities of unconsumed or partly consumed carbon are carried out of the chimney with the furnace gases, in the form of smoke or carbonic oxide—representing a sad waste of heating effect.

The above named elements contributing to the large percentage of loss in the generation of steam, from the duty which theory demands that we should obtain from our fuel, have not escaped the attention of observing steam users, boiler makers and others, as the invention of a host of contrivances—many of them very useful—for economizing fuel, fully testify.

One of the best and most practical inventions of this kind, is the improved method of furnace construction devised some years ago by Mr. K. M. Jarvis, of Peabody, Mass., and which at the present time has come into deservedly high repute among steam users throughout the country. It is usually spoken of and known as the "Jarvis Furnace," and is shown herewith in the accompanying engraving, in longitudinal section.

The prime object sought to be accomplished by Mr. Jarvis, is to effect a more perfect combustion, and therefore an increased heating effect, than it is possible to obtain in burning solid fuel in furnaces of ordinary construction; and this object he has succeeded in accomplishing without resorting to the use of artificial draft, as by blowers, steam jets and the like, and so effectually that his furnace will burn all kinds of cheap fuels, such as anthracite coal screenings, sawdust, tanbark, logwood chips, green wood, fresh-dug peat (without drying) mixed with some soft coal, and the like.

The manner in which these results are obtained is at once simple and eminently scientific, implying a correct comprehension on the part of the inventor of the conditions of the problem to be solved. Recognizing the fact that immense volumes of gasified products, arising from the fuel, are commonly passed through the fire space unconsumed, and consequently representing a material loss of available heating effect, Mr. Jarvis devised a simple plan of effecting the complete combustion of these hitherto wasted combustible elements, by providing, in addition to the air supplied through the grate, also abundant supplies of heated air along the sides and at the bridge wall of the fire space, thus furnishing the gases and vapors evolved from the first incomplete combustion of the fuel on the grate bars, the requisite volumes of atmospheric oxygen to insure their complete combustion, which before was lacking. These air supplies, be it remembered, are heated, and therefore in condition to effect an intense combustion. The manner in which the heating of the air supply is effected, is correct in principle, as will appear from the following description of the Jarvis furnace setting.

Mr. Jarvis simply utilizes a portion of the heat which usually escapes from the ordinary furnace by radiation and conduction from the walls, etc., and compels it to perform the useful work of heating the air which he subsequently admits into the fire space to complete the combustion of the gases and vapors evolved from the imperfect or preliminary combustion on the grate. To accomplish this object, the air is admitted by small flues in the front, and is then conducted through a number of passages provided in the walls, in which it travels forward and backward, becoming highly heated in its passage, until finally it is delivered in this heated state in the form of jets through perforations in sets of fire-brick plates placed at suitable intervals along the sides of the combustion chamber, and through a grating provided at the bridge wall. The heated air is thus discharged at a temperature approaching that of ignition, directly in contact with the gases and vapors arising from the fuel, and, mingling thoroughly beneath the boiler, effect a far more complete combustion and correspondingly greater heating effect, than would ordinarily be obtained. The accompanying engraving, interpreted in the light of the foregoing explanation, will serve to render the principle and action of the Jarvis system quite comprehensible.

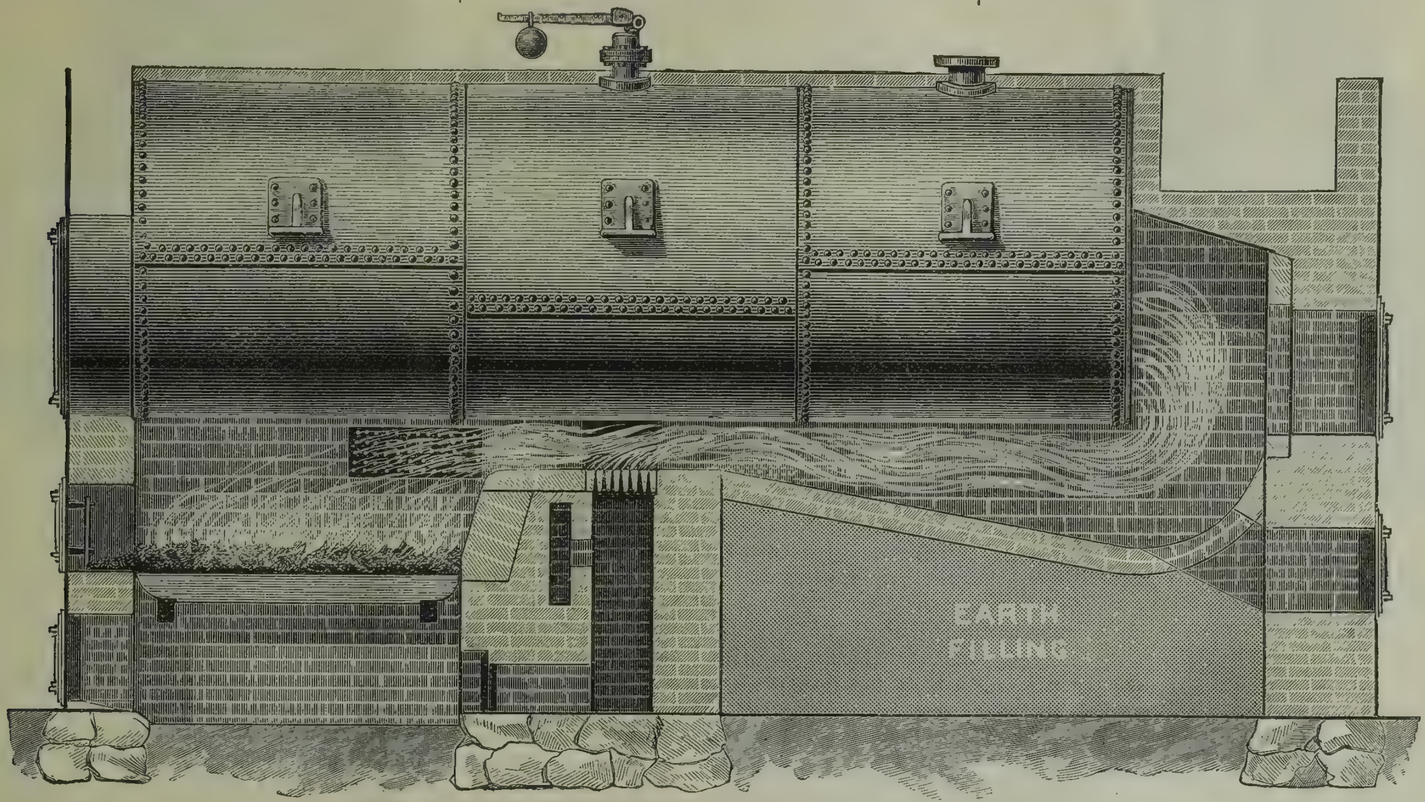
The Jarvis system, consisting substantially of a peculiar modification of setting the brick-work, can be applied to any boiler by making the necessary changes in the ordinary setting, which can be effected in a few days. The boiler may be either flue or tubular; the distance from the underside of boiler to grate may vary within reasonable limits—say from 24 to 30 inches. Grates with 50 per cent air, specially adapted to the furnace, are employed.

As above remarked, the Jarvis furnace not only yields excellent results on the score of economy—as much as 30 per cent having been demonstrated by actual tests in numerous cases—but likewise furnishes an admirable method of utilizing, with highly satisfactory results, many varieties of waste or refuse fuels—screenings, spent tan, logwood waste, sawdust, shavings, wet peat, etc. The importance of this qualification will be appreciated by numerous manufacturers who have refuse combustibles at disposal. The combustion of peat, and lignite likewise, is one which will be of considerable importance in some of the Northern and Western States and the Canadas, where fuel of this class is very abundant.

As a sample of the efficiency of the "Jarvis," the following testimony as to its action is before us: Fresh peat (wet) from the marsh is mixed with one-fourth its bulk of bituminous coal, and thrown on the fire. Within a few minutes gas flames begin to form on the flue openings, and presently the entire furnace is filled with flame, showing a practical gasification of the peat and a very complete combustion of the gases. No blower is required, as the streams of hot air thrown on the fire create a good draft and effectually consume the peat, and with good results in steaming.

The economy developed by the Jarvis furnace-setting will of course vary according to circumstances, but generally may be stated to be from 7 or 8 per cent as a minimum to 30 per cent as a maximum.

This furnace is controlled by the Jarvis Furnace Co., which company have already set over 1,200 boilers on their system. Steam users requiring further information respecting the adaptation of the Jarvis setting to their boilers, or concerning the results of such furnaces in actual practice, are invited to send communications. The principal office of the company is at No. 7 Oliver street, Boston; with branch offices at 422 East 23d street, New York; 709 Market street, St. Louis, Mo.; 18 Second street, Baltimore, Md.; 114 King street, Montreal, Que., Canada; and 210 Pearl street, San Francisco, Cal.



THE JARVIS FURNACE SETTING—LONGITUDINAL SECTION.

PAPER-BOARD has been suggested as a substitute for wood and iron in siding railroad cars.

The New Pulsometer.

The makers of this novel steam pump—the Pulsometer Steam Pump Co., of 83 John street, New York—are constantly engaged in increasing the effectiveness and extending the range and variety of its applications. At the present time, by reason of a number of recent and substantial improvements, they have succeeded in bringing it to a high state of perfection.

We present herewith for inspection, in connection

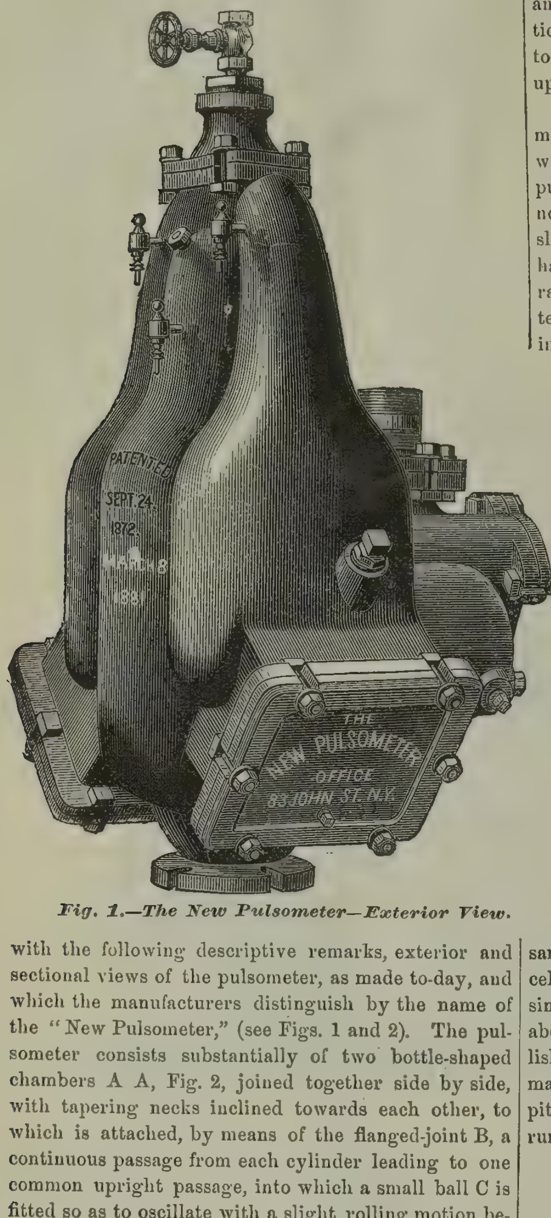


Fig. 1.—The New Pulsometer—Exterior View.

with the following descriptive remarks, exterior and sectional views of the pulsometer, as made to-day, and which the manufacturers distinguish by the name of the "New Pulsometer," (see Figs. 1 and 2). The pulsometer consists substantially of two bottle-shaped chambers A A, Fig. 2, joined together side by side, with tapering necks inclined towards each other, to which is attached, by means of the flanged-joint B, a continuous passage from each cylinder leading to one common upright passage, into which a small ball C is fitted so as to oscillate with a slight rolling motion between seats formed in the junction. These chambers also connect by means of openings with the vertical induction passage D, which openings are so formed that the valves E E, consisting of pure vulcanized rubber, and their seats F F, constructed so as to sustain the valves, may be easily inserted. The delivery passage H, which is common to both chambers, is also constructed so that in the openings that communicate with each cylinder are placed valve-seats G G, fitted for the reception of the same style of valves as in the induction passage. I I are valve guards to prevent the valves from opening too far. To facilitate the ready removal of the valves and valve-seats, it will be observed the flanges that cover the openings are slotted to receive the bolts, the nuts of which being loosened, they are readily removed and the covers displaced. J represents the vacuum chamber, cast with and between the necks of chambers A A, and connects only with the induction passage below the valves E E. K K are flanges covering the openings to the respective chambers, which may be removed for the repair or renewal of valves and seats when necessary. Vent plugs are inserted into these flanges, for the purpose of drawing off the water to prevent freezing. L L are rods extending from the valve-guards to the set-screws M M, by which the suction seats, valves and guards are tightly pressed to place. N N are brass socket-headed bolts by which the discharge seats, valves and guards are drawn down to place. A small brass air check-valve is screwed into the neck of each chamber A A, and one into the vacuum chamber J, so that their stems hang downward. The check-valve in the neck of each chamber A A allows a small quantity of air to enter above the water, to prevent the steam from agitating it on its first entrance, and thus forms an air piston for preventing condensation. The check-valve in the vacuum chamber J serves to cushion the ramming action of the water consequent upon the filling of each chamber alternately.

In the light of the foregoing, we may therefore summarize the description of the pulsometer in the words used in a former article: It is a steam pump with no cylinder, no piston or piston-rod, no stuffing-boxes, glands, cams or eccentrics, no slide valves, cranks or fly-wheels, and no exhaust. These, which were distinguishing characteristics of the earlier forms of the pulsometer, are still the distinguishing features of the improved apparatus, while the improvements in details, which those of our readers familiar with the old pulsometer will have been able to observe, are all in the direction of giving the pump greater strength and effectiveness, and economy in action, while sacrificing none of the simplicity and non-liability to derangement which is so important in the service the apparatus is designed to serve.

The applications of the pulsometer may be safely said to comprise every form of service for which a pump is required. Its construction is such that it is not liable to the numerous accidents that impair the effectiveness of piston pumps, while it is applicable for many forms of service for which piston pumps are utterly unfitted.

For draining quarries, the ability of the pulsometer to pass mud, grit and sand without injury to its working parts, and the fact that it will work when completely submerged, make it especially serviceable. The same remarks will apply to its use for draining mines, cellars, and for similar uses. As a contractor's, well-sinker's and sewage pump, its portability, and the above name qualifications, have gained for it an established reputation. For tanneries, its ready portability makes it very useful, since it can be moved about from pit to pit, suspended by a pulley on an elevated rail running the length of the pits, a flexible pipe convey-

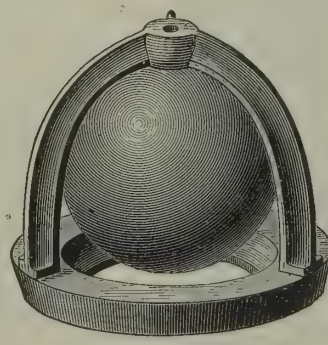


Fig. 3.—Rubber-Ball Valve.

ing the steam to the pump. For the special requirements of chemical manufacturers, gas works, breweries, sugar refineries, and other manufacturing industries, a pump of such general serviceability, with its non-liability to derangement, the pulsometer has been found a desirable acquisition.

It will be remembered, in estimating its special merits for the requirements of such service, that the wear of the pulsometer is limited to the valves and their seats, and these parts, as the pump is specially constructed to meet such emergencies, can easily be removed when worn, and replaced at trifling cost, the makers supplying duplicates of such parts for the purpose.

The material of which the pulsometer is constructed may be varied to suit the special service for which it is required, so that in chemical works and sugar refineries, for example, where it may be wanted to pump liquids destructive to iron, it may be made of lead, brass, bronze or other metal.

One of the improvements in detail that the "New Pulsometer" has received is shown in Fig. 3—the rubber-ball valve—with which the manufacturers supply their improved apparatus, and which gives a clear opening where the pump is to be used for extra dirty sewer work, pumping out the wash of breweries and slaughter-houses, the drainage of refrigerators, and for

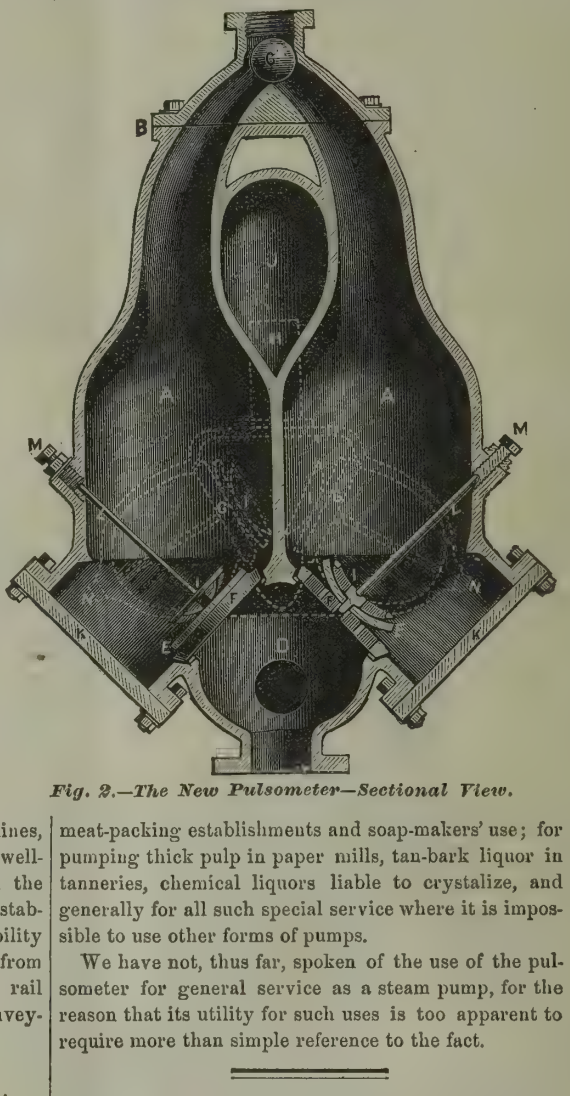


Fig. 2.—The New Pulsometer—Sectional View.

meat-packing establishments and soap-makers' use; for pumping thick pulp in paper mills, tan-bark liquor in tanneries, chemical liquors liable to crystalize, and generally for all such special service where it is impossible to use other forms of pumps.

We have not, thus far, spoken of the use of the pulsometer for general service as a steam pump, for the reason that its utility for such uses is too apparent to require more than simple reference to the fact.

Stone, Brick, Mortar, Lumber, Lath and Shingles.

The following figures are worth remembering, as they will save a great deal of calculation and give approximately accurate results with a minimum of labor:

A cord of stone, 3 bushels of lime and a cubic yard of sand will lay 100 cubic feet of wall.

Five courses of brick will lay 1 foot in hight on a chimney. Nine bricks in a course will make a flue 8 inches wide and 20 inches long; and 8 bricks in a course will make a flue 8 inches wide and 16 inches long.

Eight bushels of good lime, 16 bushels of sand and 1 bushel of hair will make enough mortar to plaster 100 square yards.

One-fifth more siding and flooring is needed than the number of square feet of surface to be covered, because of the lap in the siding and matching of the floor.

One thousand laths will cover 70 yards of surface, and 11 pounds of lath nails will nail them on.

One thousand shingles laid 4 inches to the weather, will cover 100 square feet of surface, and 5 pounds of shingle nails will fasten them on.

Explosion of a Flue Boiler.

The following criticism and analysis of the destructive explosion of a rolling-mill boiler, by the collapse of a large flue, which occurred some months ago, will be found interesting and instructive. The case is presented in the monthly bulletin of the Hartford Steam Boiler Inspection and Insurance Company:

The boiler that exploded was a cylindrical, horizontal, single-flue, built about 1870, and was 20 feet long, 4 feet diameter, made throughout of iron not less ⅜ of an inch thick. The flue was 22 inches diameter, and extended from end to end. The boiler was placed over a re-heating furnace, and heated by the waste gases, which entered the chamber below the boiler at the rear end, as indicated by the arrows in Fig. 2, passed the whole length of the boiler in contact with its lower half, and returned by way of the flue to the chimney. The boiler was supported at a hight of 10 or 12 feet above the ground by three pairs of cast-iron

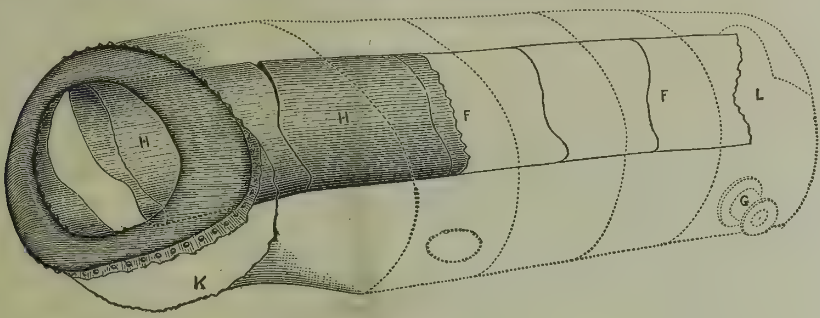


Fig. 1.

brackets, which were riveted to the shell and rested upon the side walls. The boiler had flat wrought-iron heads flanged to the shell and flue, and stayed by 12 braces about 4 feet long, part of which were fastened to T-iron placed horizontally above the flue, one on each head, and the inner ends of the braces were attached to the ring of shell plates that joined each head, as shown by the dotted lines S, S, etc., Fig. 2. This boiler was one of a system of ten which were similarly set and heated, all connected to two or more main steam pipes, and each provided with a steam stop-valve, a safety valve, and three gauge cocks, but each did not have a steam gauge. This particular boiler being without a steam gauge, there was no means of ascertaining

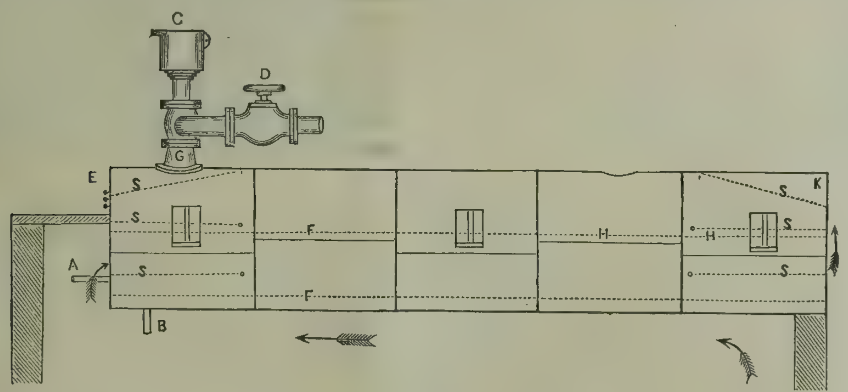


Fig. 2.

the pressure when the stop-valve D was closed, except by such indications as the 2-inch patent lock-up safety valve afforded. This boiler was supplied with water (the temperature of which is not known, but probably variable) at intervals through the pipe A, Fig. 2, as often as it got low, and no doubt as rapidly as could be done with the pump or large injector. The blow-off pipe B was located at the bottom, and afforded means of completely emptying the boiler.

About 5 o'clock in the morning, the steam stop-valve D had been closed for an hour or so to repair a steam pipe, and the 2-inch lock-up safety valve C (which had neither cover nor lock), had been blocked open by means of a bit of wood placed inside the case, to relieve the boiler while the repairs were going on. The repairs done, the attendant let down the safety valve, and was about to open, or had partly opened, the steam stop-valve, when the explosion occurred. The engravings have been prepared from photographs and sketches, and the case has been made up as well as could be from them and the published evidence given to the coroner's jury. The boiler shell, Fig. 1, containing 3½ lengths of the flue, flew through the roof of the mill, taking a direction so that it landed nearly in a line with its projected axis, at a distance of 130 yards from its working site, striking and demolishing a large area of the mill roof and a brick chimney in its flight. It struck the ground several yards short of where it stopped, and plowed a deep furrow in the ground, in which it lay partly embedded, the same end foremost that it had in the mill, by which operation the foremost head K was partly broken from the shell and the shell distorted something as shown in Fig. 1, in which the dotted lines represent the unbroken part of the shell; the shaded portion at the left shows the foremost parts of the shell broken by the fall; the shaded portion of the flue remained in the shell, and that portion in flue outlined was blown out with the missing portion of the head at the right. Of the parts of the flue that went with the boiler shell, that shown in Fig. 3 was dropped out in its flight at about one-third the distance made by the shell, while the other two, Figs. 4 and 5, remained in the shell, but entirely broken apart and from the head. The sides of the piece, Fig. 3, of the flue were shut together with such force as to emboss the forms of the heads inside upon the exterior surface opposite W, Fig. 3, and the two inner surfaces were in perfect contact, as though the iron had been soft as wax when the parts came together; but there was also visible at S, the very summit of the flue when in its place, a dark, shiny, thin scale, which is often seen inside of boilers using a particular kind of water, which had not lost its glossy appearance or changed in color, indicating that it had not been hotter than usual since the scale was deposited there. Samples of iron having on them this kind of deposit have since been exposed to heat, and it is found that a heat sufficient to change a brightened spot on the iron to a blue color—say about 550° or 600° Fah.—is sufficient to blister a deposit and destroy its luster.

The experts who testified before the coroner differ as to the cause of the collapse, and it is probable from the nature of the subject that they will always differ in such cases. Experts from the scientific schools and from the learned professions are seldom in perfect accord when giving testimony, and often their opinions differ so widely that it is necessary to appeal to common sense.

It is the object of the present writing to offer an un-

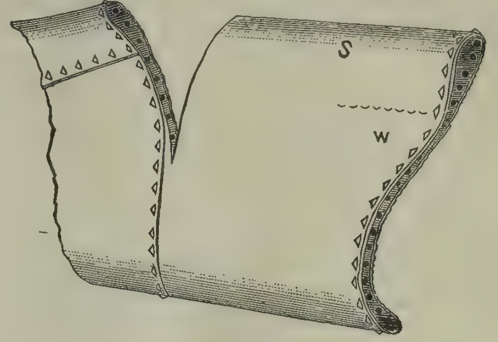


Fig. 3.

biased technical discussion of this case in the light of this company's experience, and for the good of all whom it may concern.

This boiler was a fair sample of a one-flue boiler, both as to material and workmanship, capable of bearing safely, when sound, a working pressure of 70 pounds, which was about one-third of the collapsing pressure of the flue if it was round and sound. It was run as boilers usually are in works of this kind. A man of good habits was in attendance, who believed in plenty of water as a sure preventive of boiler explosions, and his practice was in perfect accord with his faith. He was on hand and attending to his duty, which was first, last and exclusively to see that ten boilers were fully supplied with water. He did not help repair the broken pipe; his attention was therefore not distracted by that event. The feed valve was

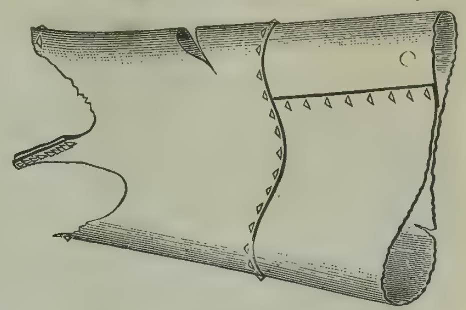


Fig. 4.

open, the steam pump was in motion while the men were at work on the pipe. So swears the engineer who repaired the broken pipe. Other witnesses swear that the boiler attendant was about there trying the gauge cocks; that he was seen trying gauges a few minutes before the explosion. The master mechanic swears that he, the boiler attendant, was directed to fill up as soon as the water fell below the upper cock; that he saw no indications of low water in the exploded boiler. Thus much, and no doubt more, evidence might be quoted relating to the probability that water was or was not low in the exploded boiler; all of which would be of no account if the theory of low water was confirmed by the testimony of the flue itself and by the general character of the explosion. Is it so confirmed? The records show that boilers which explode with no water in them, are not shot through the air like a rocket, and those containing small quantities go short

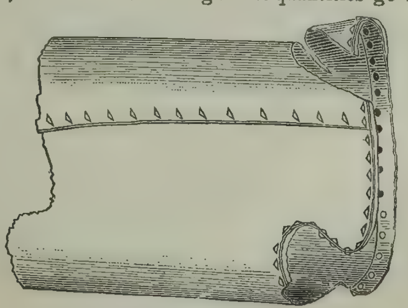


Fig. 5.

distances. The records also show that large horizontal flues that collapse on account of being softened by

heat, invariably cave in from the top only, and that lateral collapse is due to distortion of form or weakness at the side longitudinal seams from grooving or from thinning of the plate by corrosion. Two witnesses swear that grooving was observed, but as its location was not indicated little can be said about it. The parts not shown in the illustrations were cut to pieces and worked up, and no sketches or description of them were obtained. It must have been on those parts, if there was grooving, as none was found on the parts sketched.

Finally, to satisfactorily account for all the phenomena that attended this explosion, we have only to show that the safety valve was jammed so that it did not prevent the rise of the pressure, and that the stop-valve was closed, or just being rapidly opened, at the instant when the limit of endurance had been reached by the boiler; and as every circumstance and all the testimony confirm the latter requisite, we have only to imagine that this small valve, with its compound levers and disk weights huddled into a case of 8 or 10 inches diameter, and of less depth, which had been blocked open by means of a bit of wood placed against one of the levers when full relief to the boiler by its means was desired, was accidentally jammed when it was let down. The propositions below will not appear absurd to those who realize that over 3,000 cases of defective condition of safety valves, most of them originally correct and proper, had been detected by this company's inspectors during the first twelve years of its experience, out of which number 1,400 were reported as dangerous, and that thousands of defects have been reported that were dangerous only in the event of an accidental over-pressure.

The following proposition seems to account for all the phenomena attending this explosion, while the theory of low water does not: The hypothesis is, an accidental sealing of the boiler after the broken steam pipe was repaired, the stop-valve D being still closed (or in the process of being rapidly opened), and the safety valve jammed, the generating surfaces of the boiler in full action, the pressure rapidly rising, the flue—at the best only about half as strong as the shell—had acquired (from the sudden thermal changes, due perhaps to the influence of the cold feed-water among other abuses of its ten years' night and day work) an obscure weakness, flattening, thinning or grooving at a longitudinal seam, and the limit of its resisting power was soon reached at no *very* high pressure, and it collapsed near the middle of its length. The head L, being the weaker, for obvious reasons, of the two, gave way instantly when the shock of the collapse was added to its now extraordinary steam load, and it, with nearly half of the flue, fell inside the mill, and the expanding water began to issue from the open end of the boiler (the free steam from the steam space having left in one puff), while the boiler shell, with the remaining parts of the flue, started in the opposite direction, precisely as a rocket would do similarly placed after the compound was ignited, and in a similar manner it continued its flight until the explosive force was exhausted. Hence it will be seen that with so large an opening there must have been considerable contained water to send it so far.

Physics without Apparatus.

We present for the entertainment of our readers, a few selections from the very instructive series of home experiments illustrated by M. Gaston Tissandier, the editor of *La Nature* and a well-known contributor to the popularization of science.

Many ingenious and practically useful pieces of apparatus are based upon the principle of the persistence of visual impressions upon the retina.

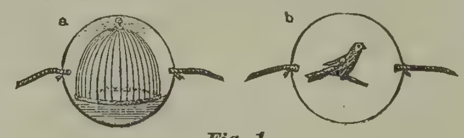


Fig. 1.

Every one knows that a lighted stick, for example, rapidly whirled about in a circle, has the appearance of a ring of fire. The rapidity of revolution required to produce this impression, is one-third of a second in a dark room, and one-sixth of a second by daylight. A meteor darting across the sky appears to leave a luminous track behind it, because the impression produced upon the retina remains after the meteor has passed by. The zigzag course of the lightning, for the same reason, appears as a continuous track.

As above remarked, a number of optical toys owe their curious effects to the continuance of an impression upon the retina after the object producing it has changed its place. The thaumatrope is one of the oldest toys constructed on this principle, and one of the simplest in construction. It consists of a disk of cardboard, which is rapidly rotated by the fingers with the aid of two cords attached to the edges of the disk. On one face of the disk a figure—say a cage—is painted, and on the other face a bird. By rapidly twirling the disk by twisting the strings in the fingers, the two objects will succeed each other so rapidly that they produce the impression of a single image on the retina, and the effect of the above named device will be that of a bird in a cage. The construction of this simple optical toy is shown in Fig. 1, and the effect it produces in Fig. 2. It is needless to add that the thaumatrope can be made to afford much entertainment by varying the designs on the card, as the ingenuity of the reader may suggest.

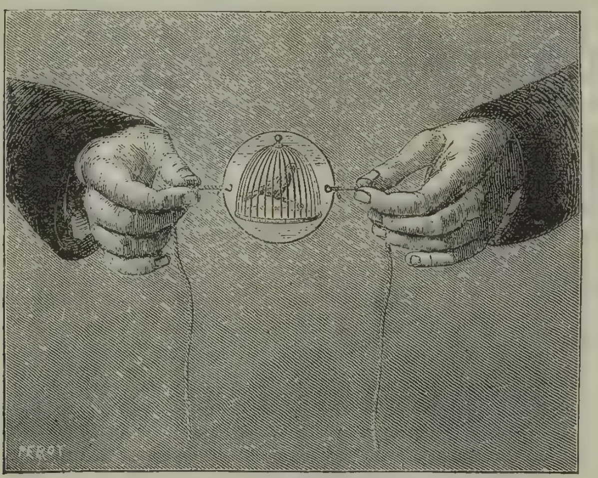


Fig. 2.

In the same manner, if any object which takes a variety of positions in moving, is painted in successive positions at equal distances on a revolving disk, so arranged that only one of the figures shall be seen at a time, the object will appear to be performing all the movements of real life. In this manner a horse may be made to appear going at full gallop, boys playing at leap-frog, a clown jumping a rope, etc. Such toys are known by a variety of names, according as they are more or less complex. Of this nature, for example, are the toys known as the anorthoscope, the phantascope, the zoötrope, and the phenakistoscope, all, however, depending for their amusing effects on the continuance of visual impressions on the retina, as above explained.

The phenakistoscope is somewhat more complex in construction than the thaumatrope, but can readily be made by any one who has a little dexterity. Its construction is shown in Fig. 3. A circular disk of cardboard is taken, and the figures of any object, or combination of objects, are painted upon it at regular intervals, the whole series representing the successive positions which the object or objects would assume in performing some movement or evolution. In the engraving, a clown is shown in the successive attitudes of jumping a rope. The painted disk is fixed on an axis, which carries on the other end a similar cardboard disk, provided with a number of longitudinal slits or openings opposite to and corresponding with the number of figures on the painted card. The apparatus is provided with a suitable holder, as shown. The disks are then rotated by the sudden release of a cord wound about them, as a top is spun, and the eye of the observer sees through the slits the rapid succession of the figures on the card. They succeed each other so rapidly that the eye appreciates them as a single object which appears to be executing a movement, or series of movements. In this case the clown is seen jumping his rope. As in the case of the thaumatrope, by varying the designs as the ingenuity of the reader may suggest, an endless variety of amusing effects may be had.

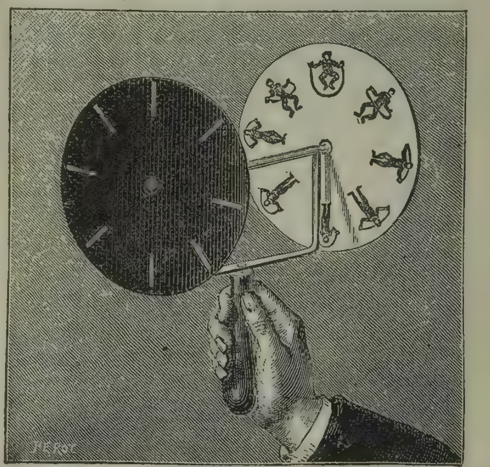


Fig. 3.

Optical toys and experiments based on the phenomenon of the reflection of light, are very numerous, and many are highly instructive and curious. The kaleidoscope, which gives exceedingly beautiful effects, is an optical toy of this kind, and can readily be made by the following procedure: It depends for its curious effect upon multiplications of images by inclined mirrors, and was first devised, we believe, by Sir David Brewster. The first requisite is to provide a pasteboard cylinder of any convenient dimensions. In this there are placed two mirrors, inclined to each other at an angle of 30°, 45° or 60°. Across the open part of the mirrors a strip of black velvet may be attached, so that the mirrors and strip may form a triangular prism. The bases of this prism, or, what is the same thing, the ends of the tube, are closed respectively by two parallel plates, one of transparent and the other of ground glass. The ground-glass base should be made double, a plate of transparent glass being placed inside, so that a narrow cell shall be formed, in which various objects, bits of colored glass, tinsel and the like may be placed, just room enough being left to allow the objects to tumble around as the tube is turned. A small circular opening should be left in the center of the transparent plate at the opposite end of the tube, to which the observer places his eye, the instrument being held to the light. The effect of this simple arrangement, is that one perceives multiple images of the small objects in the cell, arranged in regularly disposed figures, an endless variety of symmetrical combinations appearing to the view as the tube is turned, but no two alike in form or coloring. By varying the angular position of the mirrors of the kaleidoscope, the number of images observed, and the complexity of the combinations, can be altered at will. If the mirrors are inclined at an angle of 60°, the number of images seen will be six; if the inclination is 45°, the number will be eight: and at 30°, the number will be twelve, etc. It should be mentioned, however, that as the mirrors are brought closer together, to increase the multiplication of images, many of the latter, formed by successive reflections, become too faint to be seen. It is hardly necessary to hint, that by a variety of simple mechanical

artifices, the angular position of the mirrors within the tube may be altered at pleasure.

One of the most remarkable and striking applications of the properties of mirrors in the field of amusement, is shown in the arrangement of the curious experiment popularly known as "the talking head." Some years ago, when this really astonishing illusion was first brought out, it excited quite a furore, and peripatetic showmen and conjurers who exhibited it reaped a rich harvest.

The appearance of this notable exhibition is shown in Fig. 4. Visitors are admitted into a small apartment, to a certain portion of which they are confined by a railing. The only thing visible behind this railing is a table supported upon three legs. On the top of the table, and resting apparently upon a plate or dish, is a human head. The bodiless head moves its eyes and speaks. It is evidently a man, but the concealment of the body is perfect. To the spectators—confined as they are to the front of the arrangement—it seems as though there was simply an empty space underneath the table, but in reality the body of the individual to whom the head belongs, is there, skillfully concealed by two plate-glass mirrors fitted between the legs of the table, and inclined at an angle of 45° to the walls of the apartment on the right and left. The device is disposed in such a manner that the images on the walls on the right and left seen in the mirror, are absolutely indistinguishable from the part of the wall seen about the bottom of the apartment. These three walls are painted all alike of one homogeneous color. In partial obscurity, the illusion is said to be facilitated, and the effect is described as being very remarkable. To unravel the mystery, it is only necessary to cast a stone against the legs of the table, when the presence of the mirrors becomes at once apparent.

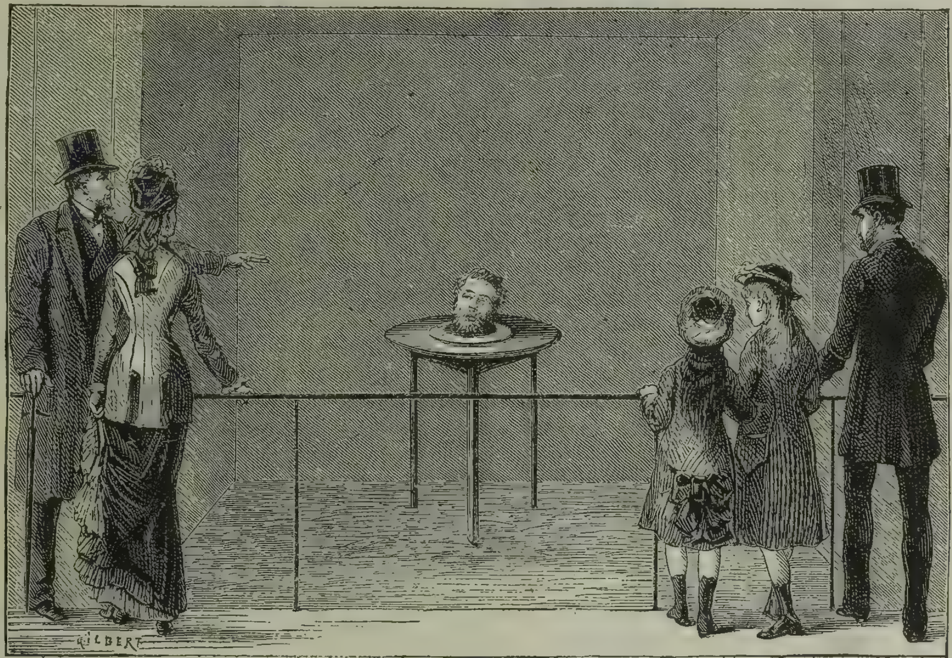


Fig. 4.

Cutting Hard Steel with Soft Iron.

A correspondent of the *Scientific American* says: "About forty years ago, having often heard that hard steel could be cut readily with a circular disk of sheet-iron when driven at a high motion, I made a disk about 10 inches in diameter out of a heavy piece of stove-pipe iron, having a round eye in the center about 1½ in diameter. I then put a stick of hard wood in the turning lathe, turned it off true, making a wooden mandrel for holding this iron disk, just as a circular saw is held true on a metallic mandrel. The periphery of the disk, after it was secured to a wooden mandrel swinging in the lathe, was ground and filed until it would run as true as a mill stone. The disk was secured to the collar or shoulder of the wooden mandrel by putting four screws through the disk into the wood. While the disk was revolving at a high motion, the soft sheet-iron would cut off a 10-inch cold steel file in a few seconds. After we were satisfied that soft iron would cut cold and hard steel (no matter how hard), the disk was put on one of the journals of a circular saw, which was driven at a very high motion; and that disk was employed for many years afterward to gum saws of all sizes.

"During the past season, having occasion in a new shop to make a goodly number of cutters for a power molding machine, we made another sheet-iron disk, which was fitted to the mandrel of one of the little circular saws, which revolved about 2,000 times per minute. After the periphery had been dressed off as true as practicable, that disk of soft iron would, and will, cut off a bar of cold steel 4 inches broad and ¼ of an inch thick, in one minute, making a kerf as true and smooth as a good saw will cut through a piece of timber. The disk will save an immense amount of filing when making cutters for molding machines, as we can cut slots into the heel end of the cutters, and cut and dress off the edge ends faster than twenty men can dress the steel away with chisels and files. One can 'gum' an old cross-cut saw, a mill saw, a drag saw, or circular saw with such a disk in a few minutes, without any apprehension whatever of injuring or cracking the saw blade. After a large saw has been gummed by an iron disk, if one has a small emery wheel of the proper form, he can dress up the teeth almost to a perfect cutting edge without a file, thus saving an enormous expense for files.

"I have found in some instances, when gumming cross-cut two-men saws, that the steel of certain kinds of saws would be case-hardened a little on both sides of the kerf made by the disk. That very thin film of case-hardened steel would wear away a new file rapidly. But by employing an emery wheel instead of files until all the case-hardened steel had been removed, the expense for files is always small. Indeed, we use files only to fit up the very points of the teeth.

"I may add for the advantage of beginners, that the true way to fit up the periphery of a disk is to cut it with heavy shears as nearly round as practicable, after which hold a piece of a grindstone or sandstone so that the edge of the disk will strike it when in motion. We always use a stone and file, and then attempt to cut steel a little, thus working off the periphery until it is as smooth and true as it can be made. Then the cold and soft iron, when in high motion, will literally melt the hard and cold steel and drive the melted metal from the bar in a stream of white-hot, sissing and burning steel dust."

American Inventions in France.

The French patent laws provide that "no foreign invention can be patented in France except under the condition that the article invented, and the machinery necessary to its fabrication, be made in France; that the inventor who manufactures the article in any other country and imports it for sale, loses his right to the invention, which then becomes public property."

It is easy to see how disadvantageously this law has operated to American inventors. But the French people are now beginning to see that it acts equally to their disadvantage. A United States inventor now takes up his patent in France simply to secure the invention in case of future requirement. He does not do so with the idea of utilizing his invention in France, because the laws of the country, as he knows, prevent his doing so with profit to himself. He would be obliged to erect a manufactory there, and have requisite machinery also made there, so that the manufactured article might be made by French machinery on French soil. This great additional expense the inventor will not, for obvious reasons, incur, and as the imported article cannot be sold without forfeiture of the patent rights, the invention remains a dead letter so far as the enjoyment of it to the French people is concerned. There have been cases where the American inventor has gone to the expense of making new machinery and erecting workshops, as, for instance, in the manufacture of sewing machines. In some cases, again, the American inventor has disposed of his patent rights for France, but they have been few in number. As a consequence, the vast majority of our useful and labor-saving machines are practically unknown to the French people.

Of late years these matters have been brought nearer home to them than ever before, and the abolishment of the restrictive clause in the patent law is among the near possibilities. At the Paris Exposition of 1878, among the different new inventions sent from this country, was the Edison electric pen. The French examined it with a good deal of curiosity, and liked it. In the United States the pen was then sold at an average price of $6, but when its proprietors were requested to make it for sale in France, they asked $20 for it. The increase in price was due to the fact that under the law they could not import the article ready made, nor make it in France except by hand, unless the machinery were made in the country. It was then that the French realized for the first time that the law, as it stood, prevented the use of many American inventions of general utility. But it is in agricultural machines that the French have been the greatest losers. It is not too much to say that in consequence of this exclusive patent law France stands to-day, so far as agricultural implements are concerned, where this country stood half a century ago. American progress in electrical matters has also demonstrated to the French the evils of their patent laws. "Why," asks M. Géraldy, one of their most prominent electricians and scientific men, "have we no important electrical works, such as the Western Electric Company, the California Electrical Works, Tillotson & Co.'s works, of New York; Siemens and Halske, of Berlin; the Telegraph Construction and Maintenance Company, of London, and others of importance both in the United States and elsewhere? Why is it that we are not competitors in the race for the improvement of the electric light? and why are there not in this country, as in the United States, large workshops, with capital engaged and actively employed in the production of a better and cheaper light?"

Their patent law supplies the answer. The fact, then, is being painfully brought home to the French people, that while, under liberal patent laws, substantial progress has been made in the United States in perfecting and cheapening articles of use and comfort to mankind, they have voluntarily denied themselves the benefit of these inventions through the imposition of conditions as unprofitable to themselves as to the foreign inventor.

Scientific.

The Extinct Toothed Birds of North America.—Since the discovery at Solenhofen, nearly 20 years ago, of a fossil bird possessed of a long slender tail of some twenty vertebræ, and having other peculiar features which showed its relationship to the reptiles, but little was added to our stock of knowledge respecting the aviar life of the past, until the discovery by Prof. Marsh, of Yale College, of the remains of a great number of toothed birds in the cretaceous deposits of Kansas. The discovery and study of these remarkable extinct forms by Prof. Marsh has thrown much light upon the derivation of the birds, and furnishes another very strong link in the chain of evidence in favor of the theory of evolution, which is now almost universally accepted by naturalists, to account for the origin of the existing forms of organic life.

Prof. Marsh has just published a valuable monograph upon those strange bird-forms, of which we give a brief synopsis: "The first specimens which were taken from the cretaceous deposits of Kansas were found by Prof. Marsh in 1870, and there are now in the Yale Museum more than one hundred individuals of this group. The deposits in which they have been found consist of beds of a fine yellow chalk and a calcareous shale, which have been little disturbed, and to this fact the wonderful preservation of the fragile bones is due. There have been found two widely separated types of Odontornithes, as these toothed birds have been called by Prof. Marsh. They both lived during the cretaceous period in the same region, and yet differed more from each other than any two recent birds. One of these groups includes very large swimming birds without wings, and with the teeth in grooves. The other contains small birds, endowed with great powers of flight, and having teeth in sockets and biconcave vertebræ. Some of the aquatic birds measured almost 6 feet from the tip of the bill to the end of the toes. There were 14 functional teeth in the maxillary bone, while in each ramus of the lower jaw there were 33. These teeth were implanted in a continuous groove, and were no doubt held in place during life by cartilage. The method of replacement of the teeth was similar to that in some reptiles. The young tooth was formed on the inner side of the one which it was to replace. As it increased in size, the facing of the old tooth became more and more eaten away, and was finally expelled by the new one. The bill was long and slender, the neck long and flexible, and there were no functional wings. The legs were powerfully developed, but were adapted solely for progression through the water, a character which those of neither recent nor fossil birds possessed. The tail was wide, long and broad, and must have been of great service in steering and diving. The second class of toothed birds were small, of the size of a pigeon, with very large, strong wings, but small legs and teeth. The teeth were implanted in distinct sockets, and were strongly recurved. The method of replacement of the teeth was not lateral, as in those of the first class, but vertical, as in the crocodile. That they were provided with feathers is proved beyond question by the tubercles for the attachment of quills on the forearm. The discovery of these two ancient types of birds, so widely different from each other, and from all known members of the class, gives many hints as to the genetic origin of birds, and proves especially interesting as confirming the generally accepted view of the close relationship between birds and reptiles."

Fish as Brain Food.—The idea that fish food is especially adapted for brain nourishment, and that by inference, fish-eating people are therefore more intellectual than the average of mankind, is scouted by no less eminent authority than Dr. Beard. Referring to this wide-spread popular notion, he terms it a delusion, utterly opposed to chemistry, to physiology, to history, and to common observation. He casts the responsibility for the almost universal acceptance of this delusion by the American people upon the late Professor Agassiz, "who impulsively, and without previous consideration, apparently, as was his wont at times, made a statement to that effect before a committee on fisheries of the Massachusetts Legislature. The statement was so novel, so one-sided, and so untrue, that it spread like the blue glass delusion, and has become the accepted creed of the nation."

The generally received fact that phosphorus is essential to the nutrition of brain and nerves, is probably remotely connected with the utterance of the fallacy that Dr. Beard denounces. The well-known phenomenon of the glowing (or phosphorescence) of fish in the dark, especially manifest when they have been kept for some time, is popularly believed to indicate the presence of a large proportion of this nutritive element. Chemical analysis, however, fails to substantiate this idea, but demonstrates that the flesh of fishes contains a smaller proportion of mineral elements than other forms of flesh food. The phosphorescence likewise is in reality simply an evidence of commencing decomposition; it is not confined to fishes, but is shown by decaying vegetation as well.

The Oceans and Continents.—It has been long a favorite theory of geologists that sea and land have been playing a sort of see-saw game for ever so many ages; that now the bottom of the sea, the great ocean floors, become the continents, and again that the great continents subside and become the floors of the oceans. Almost every modern book on geology sets forth this as something to be accepted without question. At first sight, the observed facts appear to support the view of the book-makers. The rocks, which make up the most of the continents, and the sites of the loftiest mountains, give unmistakable proof that they had been frequently under the sea. A close sifting of the facts, however, disposes of anything like the great cataclysmal notions. Continents when they lost in one direction gained in another. Recent soundings have shown that the sediments carried off the land have been deposited not more than two hundred miles from the shore. The remains of pelagic flora and fauna on dry land go to prove that the living organisms had never an existence at very great depths This is what Prof. A. Geikie, one who stands in the front rank of the geologists of our time, has to say on this subject: "Again and again the solid bulk of the continents has been reduced to mere detritus, and has been spread over the sea bottom. And yet the continental ridges have never ceased to exist. Their disappearance would necessarily have been followed by the cessation of sedimentary accumulation. The character of the component rocks, however, teaches that, whether by the operations of undergound movements or by the action of superficial causes, the land has been continually wandering, as it were, to and fro across continental areas, disappearing beneath the sea in one region, and reappearing from the sea in another. In one sense, of course, it may be said that the land and sea have been continually changing places. But the submerged land has not become truly a part of the oceanic realm. The waters covering it have been mere prolongations of the upper layers of the ocean, like the Mediterranean, Black and Caspian seas of the present day. An elevation or depression of a few hundred feet sufficed to turn wide tracts into land or into water. But such oscillations made no real change in the essential position of the grand aboriginal oceanic basins and continental ridges."

An interpretation of phenomena like that just quoted cannot fail to modify or overturn many prevalent theories, including those regarding climate and the existing location of animals and plants.

Another System for Carrying Telegraph Wires.—Another proposal to do away with the nuisance of telegraph posts and wires in the streets of our cities is made by Mr. T. B. Doolittle, who is referred to as agent for one of the telephone companies. His plan would leave the wires over ground, but in a more convenient and less unsightly manner than at present. He claims, in fact, that the mode of carrying the lines that he proposes, could be made attractive and ornamental, while it would insure the companies against loss from storms or accidents, to which they are now constantly subject.

He proposes to bunch the wires, place them in an insulated box, which would be supported along the street curb at about the hight of the first story, on pillars of light and attractive pattern. From the published accounts of the details of Mr. Doolittle's plan, we glean the following points: A certain proportion of the pillars would contain the screw cups, so that in the event of a breakage anywhere, it would be easy and economical to repair the damage by simply opening the door of the pillar and readjusting the broken wire or wires. These pillars might be utilized also for the support of lamps, and particularly for the electric light, should it come into use. The end section of the box containing the wires shows a triangle, in the sides of which are the pockets that hold the lines of the different companies. The coverings of the pockets overlap each other so as to carry off moisture or rain, and can be readily removed for the inspection of the interior. The base of the triangle (averaging 6 inches, 18 inches being required only in a few places where there is a greater congregation of conductors) is perforated for the purpose of permitting the escape of any water that might by some possibility get inside. The interior space might be made available for the insertion of a pneumatic dispatch tube. The street crossings Mr. Doolittle proposes to span by an arch of a proportion and design that would be beautiful to the eye, or, better still, to carry the wires under the crossings. By the latter method there would be no necessity to open up the roadway should a wire become broken, for in the pillars at the corners would be kept spare wires and an apparatus for withdrawing the damaged line and the insertion of the new.

We are not particularly impressed with Mr. Doolittle's plan. It certainly would be a great improvement upon the present system in vogue. It would be less unsightly, and we might even go so far as to admit that it might be made passably attractive; and it would afford protection against injury to wires by storms. But the plan would still involve the obstruction of the sidewalks, which, in the crowded thoroughfares, would be a decided objection to it. It is questionable, also, whether such a mode of carrying lines would not prove something of an obstacle to the use of fire-escapes and ladders in the constantly recurring event of fires. It would be decidedly better, we believe, if any compromise between the overhead and underground system is to be made, to construct a hollow curb in which to stow the wires out of harm's way. This would have all the advantages of Mr. Doolittle's plan and none of its disadvantages.

Relative Merits of Refractory and Reflecting Telescopes.—Mr. Thomas Nolan, B. S., in a paper in *Van Nostrand's Engineering Magazine,* on the principles involved in the construction of the telescope, concludes as follows: 1st. At the present day the largest refractor is equal in optical power to the largest reflector. It is more convenient in use, easier to manage, and better adapted to general observatory work. and it enjoys the greater permanence of optical qualities. 2d. The reflector will be the great telescope of the future if (1) specula of large diameter can be produced free from imperfections of curvature and polish; and if (2) increasing difficulties of mounting and manipulation can be overcome. If these latter mechanical difficulties cannot be entirely removed, the refractor will continue to be the "working instrument" of the future, as it has been in the past, although the future reflector may accomplish the grandest results in the domain of physical astronomy.

Extinguishing Mine Fires with Carbonic Acid and Nitrogen.—Dr. H. M. Chance, at one of the late meetings of the Engineers' Club of Philadelphia, gave an

interesting description of an attempt made to extinguish the fire in the Kehly River colliery, at Shenandoah City, by the use of carbonic acid gas and nitrogen. The gas was generated in an open brick furnace with reversed draught, and forced into the mine through four 3 inch pipes, by injectors supplied with steam at 60 pounds pressure. Each pipe was supposed to supply 1,500 cubic feet per minute, or a total of 6,000 cubic feet per minute. The attempt was entirely unsuccessful, and Dr. Chance attributes its failure principally to the impossibility of making the mine air-tight, but also considers that the gas was delivered at too high a temperature, and that it was possibly mixed with carbonic oxide. He thought, however, that the method was worthy of further trial at mines that can be made thoroughly air-tight.

Corrosion of Lead Pipe by Lime Mortar and Cement.—The observation has lately been specially brought to public notice by the publication of an article by Dr. Rossel, a German savant, that lead pipe, when placed for any length of time in contact with lime mortar or cement (which contains free lime), always undergoes a decided change, becoming converted more or less perfectly into basic carbonate of lead. Other substances, this observer states, have a somewhat corrosive action upon this metal, lead pipes in moist soil impregnated with chlorides or saltpeter being invariably attacked, but to nothing like the extent that they suffer in contact with lime. On the other hand, neither the sulphates, like plaster of Paris, have any effect on the metal; nor have the carbonates (like chalk or limestone), the silicates, clay or sand.

As illustrating the activity of the chemical action of free lime upon lead, Dr. Rossel estimates that under favorable circumstances, a pipe one-25th of an inch in thickness, may be entirely eaten through in 15 or 16 months. From his observations he makes the following statement: 1. Lead pipes should never be brought in contact with any sort of mortar or cement. 2. Clay does not attack lead pipe if free from sal ammoniac and saltpeter, the latter resulting from the decay of organic matter. 3. Plaster of Paris offers the best protection for lead pipes. Wherever lead pipes pass through a wall, they should be laid in gypsum, over which mortar or cement can then be safely laid.

The foregoing facts and conclusions are worthy of careful attention by builders, plumbers and others, in view of the common use of lead pipes for distributing water to and from our dwelling-houses. So far as we are aware, no precautions are at present taken to avoid contact of such pipes with fresh lime mortar; on the contrary, the common practice, we believe, is to plaster up the recesses and holes made by the passage of lead pipes, with lime mortar. Nor are we aware that serious results from corrosion of such lead pipes have ever been brought to light. If is safe, we think, to conclude, under the circumstances, that something more than the mere presence and contact of lime is demanded to account for the facts stated by Dr. Rossel, of the correctness of which we entertain no doubts. This something, most probably, is moisture. The most striking effects of corrosion, Dr. Rossel notes as having occurred in the case of lead pipes buried in moist earth in contact with lime. The rapid change of the metal under such circumstances would appear to be best explained on the supposition that the constant advent of fresh supplies of moisture percolating through the soil, charged with minute quantities of carbonic acid gas and atmospheric oxygen in solution, would cause the gradual conversion of the free lime to the condition of corbonate, and that this change, taking place in immediate contact with the lead, would induce a similar change in it—first, conversion to oxide by union with the dissolved oxygen in the soil water, and finally to carbonate.

In dry situations, there seems to be nothing to warrant the assumption that contact of free lime with lead will produce any notable corrosive action; and while Dr. Rossel's third conclusion is doubtless a safe rule to follow, we believe that the experience of architects, builders, plumbers and others familiar with the subject in its practical bearings, will bear us out in the opinion that his first conclusion is altogether too sweeping. If any of our readers have any facts bearing on these points, we would be pleased to receive communications from them, as the subject is one of much practical interest.

Adjustable Dado, Filletster, Plow, Etc.

This tool embraces, in small space, an ingenious combination of several tools, which in the old form would nearly fill a carpenter's chest. The parts being made of iron or steel, no change in form can result to them from weather or other cause, and no amount of use can wear them out. The tool, which is represented in Fig. 1, consists of two sections—a main stock A, with two bars or arms B, and a sliding section C, having its bottom or face level with that of the main stock.

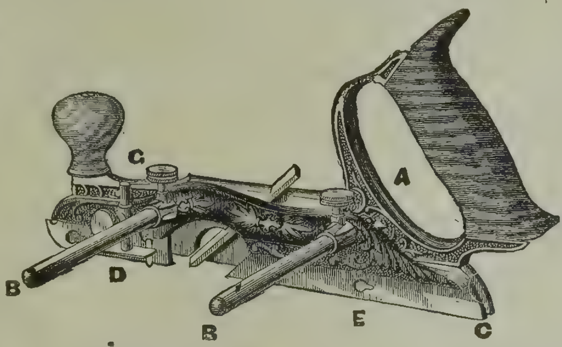


Fig. 1.—Traut's Adjustable Dado, Filletster, Plow, etc.

It can be used as a dado of any required width, by inserting the suitable bit into the main stock A, and bringing the outside edge of the sliding section C into line with the bit. The two steel spurs, one on each section of the plane, will thus be exactly in line with and in front of the two edges of the bit. The gauge D on the sliding section regulates the depth to which the tool will cut. If the tool is to be used as a plow, remove the gauge D, for regulating the depth of cut, to the socket on the right-hand side of the main stock A at G. The guard plate H (Fig. 2) should be attached to the sliding section C by means of the thumb-screws

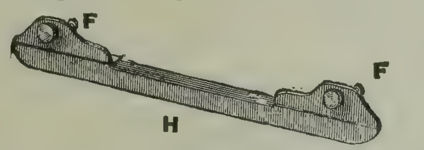


Fig. 2.—Guard Plate to Traut's Adjustable Dado.

F F. The flanged ends of the thumb-screws F F are passed from the outside through the slots E in the sliding section C, and by giving these screws a turn to the left, the two parts will be firmly secured together, and their inside faces be exactly flush with each other, thus forming a fence for the plow. Insert such bit as is needed in the main stock A, and secure the fence at any desired point on the bars, by use of the brass thumb-screws above.

A filletster may be had by detaching the guard plate H, Fig. 2, and turning it end for end. The thumb-screws F must be reversed, so as to bring their heads on the outside of the sliding section C, and the flanged end of each screw will then have its bearing in the recess on the inside of the slots E. Then tighten up the screws, and a fence will be formed for regulating the width of cut, while the parallel bottoms or faces of both sections will be left so as to rest on the work. With the $1\frac{1}{2}$-inch cutter inserted in the main stock, the fence may be moved and secured so as to give any required width of cut, from $1\frac{1}{2}$ to $^5/_{16}$ inch.

As a matching plane, the fence is used in exactly the same form as on the filletster; the heads of the thumb-screws F are on the outside, and the parallel bottoms or faces of both sections rest on the work. Insert the tonguing tool in the main stock A, and slip the extra iron gauge, which accompanies each tool, on to the upper end of the spindle of the ordinary gauge D, when inserted in the socket on the right-hand side of the main stock G. The hooked form of the iron gauge will give it a bearing directly on top of the tongue when the full depth is reached, and the required depth for tonguing may be regulated by means of the set-screw, which will secure the iron gauge at any point on the upper part of the spindle of the ordinary gauge D. The grooving may be done with the regular $\frac{1}{4}$-inch plow bit.

Enough of these tools have already gone into the hands of mechanics to make a full test of their merits, and they gain the approval of all who try them. The price of the tool entire, ready for use, is $7. They are manufactured by the Stanley Rule and Level Company, of New Britain, Conn., and are sold by all hardware dealers.

Uses of Sawdust.

In most of our large cities, this material is not wasted, but has a commercial value and is eagerly sought after by parties who vend it. In New York this is notably the case. It is said that there are as many as 500 venders of sawdust in this city. Years ago, the mills were glad to have their sawdust removed; but since then there has been a growing demand for it, and the average price paid for it by the venders is about $3.50 per load. Special machines have been patented for grinding up shavings into coarse dust, which is prepared by some of the large mills for sale to the venders.

It is sold in large quantities to hotels, eating-houses, saloons, groceries and other business houses. It is moistened with water and strewn on the floors, where it serves the useful purpose of laying the dust, and makes sweeping up cleaner work. Plumbers use it considerably about their pipes; and builders to deaden walls and floors. Soda-water men and packers of glass, china and other fragile wares, use it in considerable quantity. The markets and stables use considerable.

Yellow pine makes the most desirable material for these uses; it is less dusty than other varieties, and has besides a pleasant aromatic odor. But the dust of any of the white woods is indiscriminately used. Walnut dust is not in demand for these uses, and where it is possible to do so, it is burned.

It is estimated that there is capital of about $200,000 invested in the business of vending sawdust in this city. The quantity disposed of in the manner above described must therefore be immense.

Safety Jackets for Shafts.

Revolving shafts are, perhaps, the most prolific source of accidents in mills. One of the simplest methods of rendering these casualties impossible, without introducing the necessity of constructing a railing or fender about the moving piece in dangerous places, is to cover the shaft with a loose sleeve along its entire length. This may be made of sheet tin or zinc, and to be removed if desired. It should be covered within and at the ends with leather to prevent noise. Arranged in this manner, the friction between it and the revolving shaft would be sufficient to cause the sleeve to rotate with the latter; but in the event of any decided resistance being brought to bear upon it, as in case of the entanglement of a workman's garment, the sleeve would at once be brought to rest and permit of extraction without accident. The same idea of loose covers may be applied to cog wheels or pulleys, and prove an invaluable protection against loss of life or injury to person.

Amber.—During the past year, it is reported that the Baltic amber industry yielded some 140 tons of amber. About one half of this quantity was obtained with the aid of digging machinery. This industry affords employment to about 3,000 persons of all ages and both sexes.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch,	43 a — 44
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	90 00 a 110 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	1 40 a 1 50
Yellow dressed pine flooring	30 00 a 37 50
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	2 50	a 3 00
Up Rivers	5 50	a 6 00
Jersey	— —	a — —
Long Island	— —	a — —
Staten Island	8 50	a 8 75
Haverstraw Bay	6 25	a 6 50
" " choice	6 50	a 7 00
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown, per M.	10 00 a 11 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	— — a — —
Trenton	21 00 a 22 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	23 50 a — —
" Glengarnock	22 50 a — —
" Eglinton	21 00 a 21 25
" American, No. 1	24 00 a 25 00
" American, No. 2	21 00 a 22 00
" American, forge	19 00 a 20 00
	Store prices. Cash.
Bar, Swedes, ordinary sizes	— 6 a — 6¼
Bar, Swedes, nail-rod	— 6½ a — —

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb.	— 7 a — 7¼
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a — —
do do No. 1, blue, in rough	— 85 a — 90
Bedford Stone	1 25 a — —
Berlin Freestone, in rough	1 00 a — —
Berea Freestone, in rough	— 85 a — 90
Brown Stone, Portland, Conn	1 05 a 1 30
Bay of Fundy Wood Point Brown Stone	1 00 a — —
do Mary Point Brown Stone	1 00 a — —
do do Olive Stone	1 00 a — —
Brown Stone, Belleville, N. J	1 25 a 1 75
Granite, rough	— 75 a 1 00
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a — —

PAINTS.

*Carmine, American, per lb. gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton, gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil, gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb.	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English, gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags, gold	— 55 a — 57 ½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,)...gold	— 8¼ a — 9
Zinc, white French, in oil, gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 00
Portland (American)	2 25 a 2 50
Portland (Spanish)	2 50 a 2 75
Portland (Lafarge)	3 40 a 3 65
Portland (German, Bonner)	2 85 a 3 25
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 10 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	— 85 a — 90
" finishing	1 15 a — —
Rockland, common, cargo rate	— 90 a — —
" finishing	1 15 a — —
Ground	— 90 a — 95

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	2 00 a 2 25
Masons, do	3 50 a — —
Plasterers, do	3 50 a — —
Carpenters, do	3 25 a — —
Plumbers, do	3 25 a 3 50
Painters, do	3 00 a — —
Stone-Setters, do	3 00 a — —

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

Pipe, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

Review of the Markets.—There has been some dissatisfaction shown during the past month in the lumber market, but exactly upon what basis it is difficult to determine. About the only grade of stock upon which prices have shown any loss since the opening of the season, is spruce, and this merely went off from a winter extreme to about what might have been expected. The indications for the present month are the maintenance of a good, fair line of values, subject to such occasional fluctuation as may result through temporary lapse in demand or excess of supply; but so promising are all indications for distribution, that it is considered certain important advantages can accrue to buyers before the midsummer lull.

In the brick market the situation has been a trifle monotonous. Prices have varied but little since our last, and there appears to be no new feature whatever shown in the general form or character of business, except possibly a light falling off in demand from a few quarters, more than balanced by a lessened arrival. In fact, supply and demand have been very closely adjusted, and neither buyer nor seller can claim any advantage on the operations of the past month.

In the lime market trade has been steady and the tone cheerful. Receivers are in hopes of preserving a better balance between supply and demand during the remainder of the season, and this must afford a basis for a uniform market.

In the lath market the general indications have favored the receiver, and a comparatively steady tone has been preserved on the market during the greater portion of the period that has elapsed since our last.

In the hardware market demand has shown considerable improvement, with an occasional inclination to animation, and trade generally has had a fairly cheerful and encouraging tone.

In the metal markets American pig has been at times under complete neglect and the market in a very dull and stupid condition. In fact, the feeling was quite demoralized, and while only a comparatively moderate showing of cost was made on the surface, it was pretty well understood that in a quiet way concessions to liberal buyers would be very free. Scotch pig has been weak and unsteady. Manufactured iron has in some instances shown a little animation, but the movement was of a spasmodic character, and in common with the general market the feeling has been very unsettled throughout. Tin in pig has been rather neglected in a wholesale way and to a large extent nominal. Tin plates on jobbing parcels have been quite steady, with a fair demand prevailing and holders unwilling to offer stocks with freedom. Domestic pig lead has found a somewhat irregular demand, but at no time has developed any great amount of animation. Zinc has been fairly active. In the market for nails buyers have moved with caution, and while demand in the aggregate has reached fair proportions, it has been of irregular development, and has not acted as a stimulus to the general market.

In the paint market the movement of supplies has been somewhat irregular, and confined in the majority of cases to special orders for immediate distribution, buyers still preferring to operate close and leave the carrying of stock to first-hand holders.

The Sea of Azoff has a new island about 100 feet in diameter, and ten feet above the surface of the water. This most recent addition to the territory of Russia is the result of some subterranean disturbance. The birth of the island was attended with a marine eruption and the appearance of a fissure in the land on the shore near by.

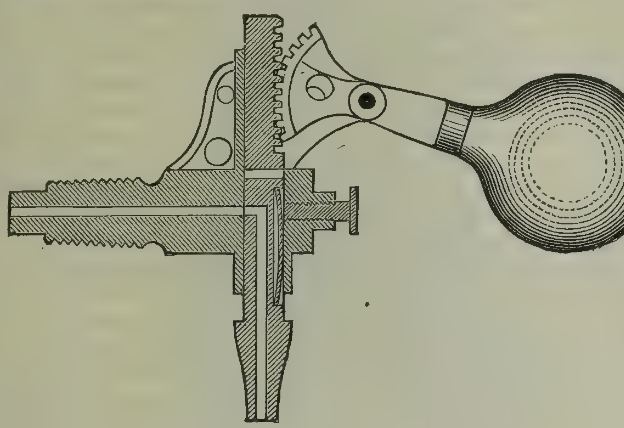
The Fairbairn Gauge Cock.

The gauge cock for steam boilers shown in half section in the annexed engraving, is a very simple and practical device, embodying certain radical changes in its construction which give it special merits worthy the attention of steam users. It is readily opened, and is self-closing; no packing is required about it anywhere, and it can be cleaned out while steam is in the boiler, without burning the hands or face. This last feature is a very important one, as there is nearly always more or less deposit or sediment in the water used in steam boilers, and the gauge cocks are very liable to get stopped up, thereby cutting off the means of ascertaining the hight of the water in the boiler, and, in fact, becoming a source of danger.

In the Fairbairn gauge cock the danger from this source is overcome by a very simple and effective process. All that is necessary to be done in such an emergency is to give the little thumb-screw three or four turns, releasing the spring, which allows the handle to be raised high enough to bring the upper hole in the piston down opposite the connection to the boiler and even with the thumb-screw, which has a hole through it, thus making a direct connection to the boiler. A wire can then be pushed clear through into the boiler, and after the passage is cleared the handle can be dropped down, cutting off all escape of steam, the thumb-screw can be turned up, and all is perfect again.

The construction of the apparatus is shown very well by the cut. The ball seen on the right is of cast iron, and may be placed directly in front or at the side, as may be preferred. The body of the gauge and the piston are made of brass or bronze, to avoid abrasion. The piston slides up or down by a movement of the ball, and except the latter is lifted by the hand the cock is positively closed. Lifting the ball throws the pipe down and connects directly with the water in the boiler, allowing it to discharge at the bottom, and the water cannot fly out all about it in the face of the operator. The illustration shows the ball partially raised, and the connection with the water in the boiler is open. This gauge has been in use several years on both stationary and marine boilers, with entire satisfaction.

Parties wishing further information respecting this device are invited to communicate with the manufacturers, the New England Gauge Co., 13 Doane street, Boston, Mass.



Fairbairn's Improved Gauge Cock.

Adulterations of Food.

(Concluded from Page 70, March Number.)

The serious question naturally comes up, Are we in these United States liable to suffer in purse and health from the adulterations that are now practiced upon our food? The reasonable answer to this question must be a qualified negative. Generally speaking, we are not suffering serious loss of goods or of health. This answer is justified by the investigations that have been made in New York, Boston and other large towns, which have not revealed very wide-spread or injurious adulterations, except in cases of milk, baking powders, and a few articles already instanced.

Some excellent people, whose apprehensions have been unduly excited, would have us believe that we are really defrauded and poisoned in a wholly reckless manner, on every hand. To understand what belongs to the numerous substances now employed as human food when genuine requires a special education which only experts can possess; to follow these foods into their manifold sophistications is another and more difficult education, and probably the fingers of one hand would suffice for reckoning the number of analysts in the United States who to-day are competent to expose with accuracy and certainty the various adulterations that are liable to present themselves in the great cities of the civilized world. It is, therefore, not to be wondered that the extent and enormity of the evil we are considering should be either suspected on the one hand or exaggerated on the other. The lawyer who in the line of business charges a prosecuted manufacturer with every misdemeanor that his imagination can in any way associate with the defendant's business; the rostrum reformer who in the line of business magnifies his calling, and everything within call; and the capable reporter who in the line of his business writes down faithfully what the logical advocate and the eloquent reformer utter, or what he thinks they ought to utter, are of those who have scared the public with overdrawn pictures.

The milk of New York and Boston has been in former years fearfully diluted, because the supply has been at times inadequate, and the cheat is one that cannot be detected easily and positively by the ordinary consumer. The tests which have been made hitherto by competent analysts are perhaps not sufficiently numerous to establish the general purity of our food supplies. The prevalence of the newspaper and the exertions of Boards of Health are having a happy effect, while the abundance of food and the comparative absence, except in our largest cities, of a "poor class," largely cut off the inducements to make a business of adulteration. But the inducements are not wholly wanting; the fact of adulterations exists among us, and whenever the falsification of any article can be carried on with much profit and little risk, that moment the adulteration will most probably begin. As our population increases in density, as the competitions of trade and the struggle for existence becomes sharper and fiercer, the mischief will increase, and can only be averted or restrained by the strong arm of the law, backed by popular intelligence.

It is evident the duty of our State and municipal authorities to ordain and enforce such wise laws as shall confine food adulterators to the very narrowest limits. A comprehensive statute ought to be enacted applying to all adulterations and falsifications. It should define in plain terms what constitutes genuine legal milk, bread, mustard, and so forth. It should provide for the employment of competent public analysts trained in chemical analysis and microscopy, to examine and test any article that may be submitted. Such tests ought to be made for any person bringing samples under suitable regulations, at a very moderate charge, and it should be provided that any article on sale of suspicious or doubtful character, be liable at any time to be analyzed at public expense, so that the poor, who can rarely sustain the cost of such tests, may nevertheless enjoy their protection. The attempt to legislate bills of such a character would doubtless develop an amount of lobby opposition that would fully demonstrate the need for their enactment.

While adulterations that are positively injurious to health are perhaps rare among us, there is not improbably a vast aggregate leakage of honest people's money which might be checked by making known what we are all ignorant of—namely, the real quantities and qualities of nutriment in the supplies we purchase or produce.

The British "Sale of Food and Drugs Act," as amended in 1875, provides for the appointment of public analysts in the various cities, counties, districts and boroughs, and for the inspection and testing of food by and under direction of suitable officers at the public cost, as well as for making tests for individuals at a small charge. The Society of Public Analysts of Great Britain now forms a large and respectable body of experts, which publishes a journal of its experience in tracing and exposing adulterations, and exercises a highly beneficial influence on the health, comfort and conscience of the British people.

How long shall we rest under this great evil, actual or imminent, of food adulteration before we shall provide ourselves the cheaply furnished means of keeping its devastations within the narrowest bounds?

The New England Manufacturers' and Mechanics' Institute.

The New England Manufacturers' and Mechanics' Institute, which has been organized through the efforts of the leading Eastern manufacturers, is actively engaged in erecting an exhibition building at Boston, which, when completed, will be the largest permanent building ever erected in New England. The building will be in the form of a parallelogram, 403 feet 4 inches wide and 551 feet 6 inches in depth, thus embracing an area of 351,834 square feet. There are to be two towers, each 30 feet square and 86 feet in hight. Extending back from the front to a depth of 104 feet, and 252 feet in width, is to be a hall, the floor of which will be a raised platform above that of the principal exhibition department, which will have a seating capacity of 10,000 persons. Above this, and extending around the entire building, will be a gallery 63 feet wide, which will be used as exhibiting space. Beyond the hall is to be a nave, extending to the rear of the entire building, 126 feet wide and 80 feet high to the apex of the roof. The entire roof of the building will be of iron, containing 2,100 squares. The trusses of this roof, galleries and supporting columns are also to be of iron.

The Institute is a joint stock company, having at its command a capital of $300,000, which is divided among 1,000 of the most influential manufacturers of the six New England States. While the aim of the Institute is the permanent establishment of a full and adequate exhibit of machinery and the manufactured products of New England, it will not be exclusively local, but open to exhibitors of the world at large.

A very detailed catalogue will be compiled, which it is proposed to have ready at the opening. The first exhibition of the Institute will be opened about the middle of August.

The "Zero" Refrigerator.

One of the most valuable adjuncts to modern life is the refrigerator, preserving our food as fresh in the hottest months of summer as in the cold season. Among the various styles in the market the "Zero" has long been prominent by reason of the many excellent merits it possesses, among which may be mentioned beauty of design and excellent workmanship; the absence of all communication between the ice and provision chamber; the absence of moisture on the inside lining; the impossibility of the contact of hot air with the ice; the condensation of the moisture contained in the provision chamber on the cold surface of the ice-box, which, running off into a trough, is passed out at the bottom; the economy of ice and uniformity of temperature; and the filling of the refrigerator with cork and charcoal, which are good non-conductors, cleanly and odorless. These refrigerators are being used in many hotels, flats and private houses throughout the country, and seem to give general satisfaction. The manufacturer is A. M. Lesley, of 380 Sixth avenue, this city.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

NEW YORK CITY BUILDING ITEMS.

On the site of the "Aquarium," corner Broadway and Thirty-fifth street, a theater is to be built for F. S. Chanfrau, the well-known actor.

A large apartment house, to cover 100 x 115 feet at the corner of Fifty-seventh street and Seventh avenue, is to be built in the Renaissance style from designs by J. G. Prague, the cost of which will be $175,000.

A Hebrew Benevolent Orphan Asylum is to be erected in Tenth avenue, extending from One Hundred and Thirty-sixth to One Hundred and Thirty-eighth street. It will accommodate six hundred children.

J. & C. Fisher, piano-makers, are to erect a brick factory, 70 x 100 feet, nine stories high, on West Twenty-eighth street, between Ninth and Tenth avenues, from designs of G. B. Pelham. The cost is $35,000.

Edward Clark has commenced excavating the plot of ground on the northeast corner of Seventy-third street and Ninth avenue running east 600 feet, preparatory to building thirty-six first-class four-story and basement dwellings.

On the southwest corner of Second avenue and Seventy-third street a six-story brick cigar factory is to be built. It will have 51 feet front, with a depth of 110 feet. Sutro & Neumark are the owners, and the cost is to be $40,000. A. B. Ogden is the architect.

At 674 and 676 Washington street a brick building for storing ice is to be erected by Beadleston & Woerz, the brewers. It will have a frontage of 54 feet, and a depth of 110 feet 5 inches. Its hight is to be five stories, and cost, $50,000; A. Pfund is the architect.

E. H. Kendall, architect, has prepared designs for four apartment houses to be erected on 55th street and 4th avenue, for the Messrs. Goelet. The elevation will consist of five stories in Queen Anne style, with high stoop and basement. The cost is to be about $100,000.

The average cost of buildings erected in this city in 1880 was over $100,000, and this has been about the average since 1873. In 1872 there were 1,729 buildings erected, costing $27,884,870; in 1873, 1,311 buildings were erected, costing $24,936,535. In 1879, $22,567,212 was expended in constructing 2,200 buildings.

A. J. Dam & Son have completed negotiations for the construction of an eight-story building on the south side of Fifteenth street, just off Union square. It is intended for a family hotel. The first story and basement will be of Dorchester stone, and the other stories of brick. The building will cost $100,000.

H. J. Schwarzmann & Co., the architects, have prepared plans for a home to be erected for the Society of B'nai B'rith at Mount St. Vincent on the Hudson. The building is intended to accommodate one hundred persons. It will be built of brick, with stone trimmings. Its hight is three stories with attic, and the cost $75,000.

Mrs. Anna Ruppert and others are about to erect three flats on East Forty-fifth street and one on Forty-sixth street, from designs by William Kuhles. They will each be 25 x 63.3 feet, with extension 9 x 16 feet and five stories high, with basement. The fronts are to be of Philadelphia brick, with brown stone trimmings. The cost is $50,000.

On the southeast corner Hudson and Leonard streets a nine-story building is soon to be built. It will be constructed of molded brick, with brown stone front. It is to be 100 x 40 feet on Leonard street, and 116 feet on Hudson. It will be 100 feet high above the curb, and used for stores. It will have four elevators. The boiler-room will be underneath a 12-inch granite walk. The lintels will be of iron. Robert Ogden Goelet is the owner. The cost is $100,000. E. H. Kendall is the architect.

On the south side of Sixtieth street, 250 feet west of Broadway, an apartment house is soon to be built. The main building is 70 feet deep and 90 feet over all. It will have a frontage of 75 feet, with an extension of 19 feet 6 inches. It will be six stories high, and be built of brick, trimmed with Ohio stone. There will be eighteen suites, each containing nine rooms. It will have a butler's pantry extension, and be heated by steam. It will also have a steam elevator. The finish is to be hardwood. The front will be plate glass. It will cost from $90,000 to $100,000. Margaret Crawford is the owner and A. B. Ogden the architect.

A church is to be erected on the corner of Madison avenue and 66th street, for the Church of the Holy Spirit. The front and side walls will be of brownstone, and an octagon tower of the same material, surmounted by a steeple and cross, will stand at the south-west corner of the edifice. The roof of the tower and the clear-stories will be covered with tiles. The windows will be of stained glass. The pine ribs of the roof will be exposed in the interior of the building and polychromed, while the ceiling and walls will be handsomely frescoed. The seating capacity will be 900. The basement will be alloted to the Sunday-school. The apartment will be twelve feet in hight, affording an airy, commodious school-room.

A. Mowbray is about to put up two houses on the north side of Sixty-ninth street, from plans draughted by Lamb & Wheeler. They will be 26 x 97 and 34 x 85 feet respectively. In the first story is to be a parlor, library, reception hall and butler's pantry. In the widest house there will be private spiral stairs running from the basement to the top of the house. Lifts will run from top to bottom. In the basement, the billiard room, laundry, kitchen, and servants' pantries communicate with the butler's pantry by private stairs. There is a fire-place in the wide house, at the balcony overlooking the platform of the stairs. Above the second story all the apartments are arranged in saloon style, with toilet, bath rooms, and so forth. The servants' apartments are in the fourth story. The houses are to be four stories high, with basement, constructed of a combination of brown stone, rubbed, tooled and carved. The cost of the two houses will be upwards of $90,000.

The plot of ground on Twenty-third street, between Seventh and Eighth avenues, formerly occupied by the Ninth Regiment as an armory, is now being excavated for the foundations of a magnificent apartment house. The plot is on the south side, 200 feet west of Seventh avenue, 175 x 88.9, and adjoins the Twenty-third street Presbyterian Church on the east and the Third Reformed Presbyterian Church on the west. The structure, when completed, will be known as "The Graham," and will be seven and eight stories high, and will contain forty-two apartments, besides steam drying rooms, storage rooms, etc. The building will be essentially fire-proof; the principal staircases will be of iron and marble and the rear staircases of solid blue stone, built into the brick walls. The halls and principal rooms will be furnished with cabinet work, in hardwood, with bronze locks, etc., on the doors and windows. It will be built on solid rock and the plumbing will be arranged with all the modern improvements in sanitary science. The system of drainage will be as complete as that of any apartment house in this country. Equal attention has also been paid to ventilation and steam heating. Each principal room and all the hallways will be heated by steam free of charge, and each room will have an open fire-place. All the interior rooms will open into large yards. There will be three hydraulic elevators. The main halls will have tiled floors and will be wainscoted from top to bottom with marble. The front will be of Philadelphia brick with bands of light limestone, of which latter material the cornices will be constructed. There will be three entrances on Twenty-third street, which will be handsomely ornamented with columns of polished Scotch granite. The tynpanum will be of sculptured limestone. On either side of the main entrance there will be large bay windows extending to the top of the third door. John G. Hyatt is the owner of the property, and it will cost him when completed, including the price of the ground, $690,000. The architect is Henry J. Dudley.

MISCELLANEOUS.

J. C. Dueber is to build a $30,000 watch-case factory at Newport, O.

Keuffel & Esser will soon complete a factory for the manufacture of mathematical instruments, on Fourth street, near Adams, Hoboken, N. J.

At Coney Island, W. Vanderveer is to erect a mammoth bathing pavilion, 200x60 feet, to contain 700 separate bathing houses. It will be fitted up with a restaurant, billiard and bar rooms. There will be a large cupola in the center, and a small one at each end. It is to be constructed by days' work, and will cost, when completed, $75,000. R. Dixon is the architect.

C. Edward Fougera will erect a large apartment house on Atlantic, Clinton and State streets, Brooklyn. It will have a frontage of 180 feet on Clinton, 91 feet 6 inches on Atlantic, and 91 feet 6 inches on State street. It will be built of brick, with stone trimmings, and be seven stories high. In it will be eight stores and forty suites, each suite containing eight rooms. It will have a steam elevator for the use of the tenants, and one for the use of servants. The grand entrance hall will be fire-proof throughout. The servants' stair-case will also be fire-proof. It will contain all the modern improvements, and be constructed in the most substantial manner. This structure is intended to be equal to the best buildings of its class in New York.

A fine hotel is rapidly approaching completion in the Catskill Mountains. It is being built by Philadelphia capitalists, and is to be called the Hotel Kaaterskill. It is situated on the summit of South Mountain, about 16 miles from the village of Catskill, on the Hudson, and three-quarters of a mile from the old Mountain House. It is 3,500 feet above the Hudson, and commands a splendid view of the river. It is 324 feet long, facing the river, and four stories high, with towers at either end and in the center. These towers are to be illuminated by the electric light. The house, which is built from designs by S. D. Dutton, of Philadelphia, will have 325 rooms, and next year will be enlarged by the addition of 225 more. It will be fitted with all modern conveniences, and a large laundry and stable will be attached. The proprietor of the house is George Harding, of Philadelphia. The cost will be about $250,0000.

Joseph Fahys is building a large silver watch-case factory at Sag Harbor, Long Island, which will give employment to about 400 persons at the start, although it will be sufficiently roomy to accommodate 600. The two main buildings will be 200 feet each in length and three stories in hight, and will be connected by a third structure 100 feet long. Five separate buildings, each one story in hight, will be used respectively for annealing and melting purposes, a blacksmith shop, and the boiler and engine rooms. All these buildings will be of brick, with granite trimmings, their floors of stone, and their roofs of iron, making them absolutely fire-proof. They are to be fitted with every convenience that a community of workingmen could desire. Steam will be used for heating, and gas (made on the premises) for illuminating. The engine-house will contain an engine of 80 horse-power. The boiler chimney will be 105 feet in hight. The factory will be inclosed with a high fence, and entrance to and egress from it will be by a single doorway. A large boarding-house will be built in the village for the accommodation of the employees. Great precautions have been taken against burglars in planning the factory. A vault will be built in one of the main buildings, with an inside area of 10 by 13 feet. It will be of granite blocks 1½ feet in thickness, and the top and bottom will be of the same material. These blocks will be doweled with cannon balls, so that prying them out of position will be an impossibility. This granite pile will be sheathed from top to bottom in a brick wall one foot in thickness. Massive iron doors will lead to this vault from the three floors. The cost of this factory will be in the neighborhood of $100,000.

Home Department.

A Power for Young Men.

We like the teaching of an elder philosopher, defining *power* to be that in a cause by which it produces its effect. This view of power sets it forth as a working energy, an actual going over of the cause to secure its appropriate results. So that we may say, it is not power except in a passive sense, when it ceases to work. Lay it by silent and idle, and it has disappeared from our recognition and calculation. What is it if it does not act? How empty is the boast "I could if I would!" There is no demonstration of *having* without *using*. What is the advantage of having a force never harnessed to the weight it was designed to draw? Where's the power? It is a wise thing for a youth commencing mercantile life, to determine rightly in what direction he will become powerful. This is the era, apparently, of physical development. Ball-playing, boating, pedestrian feats, and athletic exercises largely engage popular attention, and many a youth is attracted by this peerage of human muscles. To be strong in the loins, to have a muscular arm, to be able to lift so many pounds, is the hight of the ambition of many a youth, who cares not how empty his head and heart may be, so that his limbs and ribs are strong. But this sort of hero has had his day. The world has outgrown him and left him behind with his own boyhood. There is a truer and better power for the youth who would lay hold of his age and make himself felt.

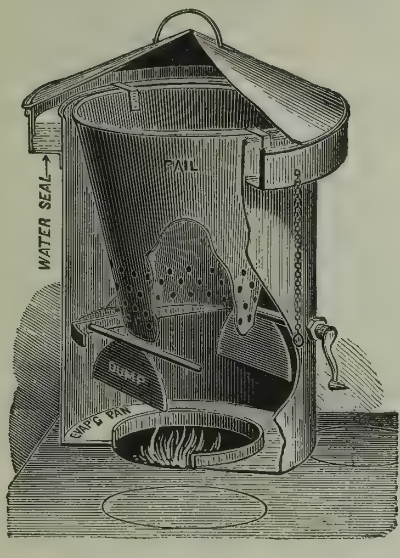
We call this greater kind moral power. No business youth can afford to lack it. It is just, it is unselfish, it is true. It goes forth in right doing, as a full fountain flows down its open channels. More and more is this kind of power a puissance in our day. It is recognized; it is relied upon; it is obeyed. It assumes kingliness year by year, and stretches far and wide an imperial scepter. It was of this that Daniel Webster spoke, when his heart surged up its deep tides against the insolent tyranny of the Russian Czar: "Gentlemen, there is something on earth greater than arbitrary and despotic power. The lightning has its power, and the earthquake has its power; but there is something among men more capable of shaking despotic thrones than lightning, whirlwind or earthquake, and that is the excited and aroused indignation of the whole civilized world." This indignant protest of humanity is the protest of a universal feeling in sympathy with justice and right. And this power, too, may be universal. It is not restricted to a favored few. The humblest mind, the lowliest youth may wield it. In this respect it is unlike some other acquisitions of power, which, like the light of setting suns, are for the tall peaks, leaving the lower slopes and the vales in the shade. Any young man who will hold and use the truth, who will make right sacred and regnant to itself, who can feel the glow and shed the light of steady uprightness and unwearied well-doing, can become a partner in this controlling supremacy.

How to Dispose of Kitchen Garbage.

The disposal of kitchen garbage is one of the standing annoyances to the cleanly housekeeper. In the country, or in the suburbs of our cities and towns, where the pig-pen is conveniently at hand, no trouble is experienced in ridding the premises of this form of refuse; but in the cities and towns the best regulated efforts for its removal are but indifferently successful, and in the summer season especially, when the attempt is made to save it, it speedily undergoes decomposition and becomes a putrid, offensive and unwholesome nuisance, an abomination to the nostrils, and a menace to the health of those who are forced to inhale its disgusting emanations. To avoid this constant and often intolerable nuisance, many intelligent housekeepers adopt the sensible course of burning it in the kitchen range as fast as it accumulates. Where this is done properly, the method is effective and inoffensive, the gases and vapors evolved during the burning of the refuse being carried off with the other combustion products by the chimney, harmless and unperceived.

There are some practical objections, however, to the plan of burning the refuse of the kitchen directly in contact with the fire, which are due chiefly to the fact that the stuff, composed largely of the parings and other rejected portions of vegetables, bones and other animal refuse, is largely charged with moisture. This water must first be driven off before the refuse will commence to burn, and this takes considerable time, or demands that the garbage shall be thrown in in small quantities at a time, which implies personal care and attention to the operation. The proper way to effect the burning of kitchen garbage, is manifestly first to thoroughly dessicate it and to throw the dried material into the fire where it will be immediately consumed.

A very practical and excellent household apparatus for disposing of kitchen garbage upon this plan is shown in the accompanying engraving, and will be understood from the following description: It consists of a pail for the reception of the garbage, provided with a set of perforations, and with a dumping bottom which can be closed to hold the charge or opened to dump it when dried, by turning the crank seen in the



The Domestic Garbage Burner.

cut. This garbage pail is suspended within an outer cylinder having a circular opening in its base, so that it may fit over one of the openings of the range, and a close cover whose edge dips into a water-seal.

To use this apparatus, it is placed over one of the openings of the range. The dumping bottom of the pail is closed by raising the crank and putting the ring over the handle, the garbage is emptied into the pail, the water-seal filled, and the cover put on. After half an hour or so more or less, according to the nature and quantity of the garbage and the heat of the range, the contents of the pail will be found to be thoroughly dried, and may be dumped into the fire and burned by releasing the crank handle from the ring. During the drying of the charge, all the disengaged vapors are either condensed in the water-seal or dissipated with the vapor from the evaporating pan. By the peculiar construction of the apparatus, the contents of the pail are hermetically sealed within it, and none of the vapors find their way out of it; consequently no unpleasant odors are given off during the operation. The dessicated garbage is immediately burned as it is dumped into the fire, and the whole operation is effected simply, expeditiously and with no disagreeable accompaniments.

The method and apparatus here described is worthy of the highest recommendation, not only because of its convenience and cleanliness, but also on the much more important ground of sanitary considerations. No intelligent housekeeper requires to be told that the foul emanations from putrefying garbage receptacles, which no amount of cleansing will suffice to keep clean, are, in addition to their extreme offensiveness, also in the highest degree unwholesome, in that they can become the carriers of the germs of pestilential fevers, which are most insidious in their approach and very frequently fatal in their results. To unwholesome influences of this kind the children of the household, by reason of their superior sensitiveness, and women, for the reason that their domestic habits keep them constantly exposed to their effects, are especially susceptible. We highly approve of the method and apparatus here described for disposing of kitchen garbage, as affording a simple, efficient and expeditious means of doing away with an offensive and unwholesome domestic nuisance.

The apparatus is manufactured and for sale at Myers' Sanitary Depot, 94 Beekman street, New York.

Mr. Myers' establishment is essentially a sanitary depot, not only for the sale of all improved plumbing goods, but for sanitary appliances of every description. Architects and housekeepers have found it greatly to their advantage to visit this depot before building or making repairs.

The Bridgeport Wood-Finishing Company's Products.

Our attention has lately been directed to the improved wood-filler, silicate paints and other products of this company, which possess many meritorious features. The first named of these products, which is known by the trade name of Wheeler's Patent Wood-Filler, is particularly worthy of notice. It is specially for filling the grain and finishing the surfaces of wood. In the cabinet-maker's art, and generally wherever it is desired to give a high finish to the surface of wood, it is first necessary to fill the grain with some material, called technically a "filler," which shall cause the fibrous texture to disappear and leave the surface smooth, repellant of moisture, and in a suitable condition to receive a permanent polish. The requirements of a material of this kind are peculiar; it must be a non-absorbent; it must fill the pores of the wood so perfectly that it shall make a hard, smooth and permanent surface, while at the same time it shall not deaden or impair the natural beauty of the grain and the texture of the wood. Many materials, and combinations of materials, have been made and used for this purpose, among which we may name beeswax, copal and various gums, starch, pumice stone, plaster of Paris, etc.; but none appear to have combined the desirable and requisite qualities of a perfect filler. They either absorbed the varnish subsequently applied for finishing, shrank, or discolored the wood.

Appreciating the defects of the fillers in common use, the inventor of the filler here described set himself to the task of finding a material for the purpose which should be non-absorbent and transparent, which should fill the tissue of the wood, and which should give it a hard, smooth and permanent surface, without detriment to the grain and texture, and leave it in proper condition to receive the final finish. These conditions he succeeded in realizing in a most satisfactory manner by the use of finely pulverized quartz, flint or feldspar mixed with oil or varnish, or other suitable vehicle for incorporating it into the surface of the wood. The process will be best understood from the following brief account from the inventor's description:

He uses finely powdered flint, quartz or feldspar, which are non-absorbents of moisture or liquid of any kind, and which fill the pores of the wood by the particles packing together similar to a concrete, and which are combined with any fluid substance that will permit their being rubbed into the surface, such as oil or varnish, or other similar fluids. The finely powdered flint or quartz being so mixed to about the consistency of jelly, and colored, if desired, to match the wood to be filled and polished, he thins the composition with turpentine to the consistency of flowing varnish, and applies it to the surface of the wood with a brush, going over no more surface at a time than will admit being cleaned off before hardening. After the filler has set (having the appearance as if the gloss had left it), he rubs off with excelsior or cloth, rubbing across the grain when practicable, then cleans out the crevices

in the ornaments or moldings with a stick and cloth or stiff brush, after which, with a cloth or rag, he thoroughly wipes the work off. This treatment leaves the pores of the wood entirely packed, and when the filler has dried, which will take place in about eight hours, it presents a smooth, hard and glassy surface of great durability, upon which one coat of varnish will produce all the finish desired for fine furniture.

This filler has been found to answer the practical requirements of cabinet-makers and others in the most satisfactory manner. It has gone into extensive use in many of the largest establishments in the country; it has effected a large saving in time and cost in the manufacture of furniture, in that it is found practicable with its use to obtain a superior finish with a single coat of varnish; and it has been found, when properly used, to greatly enhance the natural brilliancy of the wood to which it is applied.

The validity of this highly useful invention has just been confirmed by Judge Shipman of the United States Circuit Court for the District of Connecticut, after protracted litigation, which resulted in a complete victory for the Bridgeport Wood-Finishing Company, who are the owners of the patent.

One of the prime merits of this process resides in the fact that it makes it possible to secure a perfect finish on all kinds of wood with the use of a minimum quantity of varnish or other foreign substance. It likewise avoids the old process of oiling the wood, which has an objectionable effect upon the character of the finish, while at the same time it has a modifying effect upon the color of the surface, rendering it darker, obliterating the lighter shades, and destroying the contrast which constitutes an important element of its beauty. The new process employs very little oil, and that with a larger amount of dryers, so that the wood becomes quite dry and hard in a few hours, and the fiber of the wood being filled with a hard, firmly fixed and unchangeable substance, the varnish that is subsequently applied cannot strike into the wood and change its color, but lies smoothly upon the surface, giving that brilliancy and effect to the natural color and grain that is so much desired and sought after.

In addition to the wood filler above described, the Bridgeport Wood-Finishing Company likewise manufacture an extensive variety of paints, dryers, and the like. The paints, which have attained an excellent reputation, are known by the trade name of Breinig's Lithogen Silicate Paints. Respecting these paints, of which we have before us at the time of writing samples of a number of different colors and shades, we may add the following abstract of the claims of the manufacturers: It is claimed that they are not poisonous; that they will not fade or discolor by age; that they will dry firm and elastic; and that they will neither crack, peel nor chip like white lead. Furthermore, the claim is made that they are water-proof, and that they will successfully resist the action of salt air. As regards body, covering properties, durability and beauty of finish, they leave nothing to be desired.

As prepared by the manufacturers, these paints contain all the necessary drying property, so that the addition of a dryer is unnecessary. They are not liquid paints. For inside work they require the addition of spirits of turpentine for thinning, and for outside work raw linseed oil. They are prepared in all the principal shades of color, from pure white to black, and when applied to wood, stone or metal, they produce on drying a stone-hard, enamel-like surface.

For information respecting the miscellaneous products of these manufacturers, as well as for further details concerning those specially referred to in this article, we refer our readers to the Bridgeport Wood-Finishing Company, D. E. Breinig, agent, 40 Bleecker street, New York.

Industrial Exhibition in Bavaria.—It is announced that an exhibition of the arts and industries of Bavaria will be held in Nürnber next year, and vigorous preparations are being made in the way of building. Already contributors to the number of 1,702 have promised to assist, and the whole affair is to be on the grandest scale.

The Cope & Maxwell Co.

The Cope & Maxwell Manufacturing Co., of Hamilton, O., state that trade with them is remarkably good. They are continually adding to their already large works and plant, tools and appliances to facilitate the filling of the large number of orders now on hand. They are now working, in addition to the day force, a night gang until 10 o'clock, and as soon as more workmen can be had, will run all night. They have in hand one pair of compound condensing sewage pumping engines of 5,000,000 gallons capacity per 24 hours, for the Pullman Car Co., at Pullman, Ill.; one pair of condensing plunger pumping engines, of 2,000,000 gallons capacity for 24 hours, four large tubular boilers of steel, boiler-feed pumps and all connection pipes complete, for the Springfield (O.) water-works; one set of high-pressure plunger pumping engines, of 3,000,000 gallons capacity per 24 hours, for H. C. Frick & Co., of Pittsburgh, Pa., to force water through ten miles of 12-inch pipe; one high-pressure plunger pumping engine for the high-service supply of Cincinnati waterworks; one large power fire-pump for the Friend & Forgey Paper Co., of Franklin, O.; one set of five Cornish pumps complete, with connections, plunger 12 inches diameter and 8 feet stroke, for the Moulton Mining Co., of Butte City, Mont. The demand for all regular stock sizes of mining pumps, fire pumps, and boiler-feed pumps is unprecedented, requiring these works to run to their utmost capacity. The prospect for trade in the future is very flattering indeed, and the tendency of prices is upward, in order to keep pace with the increased price of labor and material. The company state that skilled labor is very much in demand.

Miscellaneous and Advertising.

At Zurich, Switzerland, where the Siemens crematory furnace has been introduced, there is a distinct stipulation that the ashes of the dead must remain in separate urns at the crematory for twenty years. At the end of that time the nearest of kin to the deceased may take the urn to his dwelling, and if this is not done the ashes are interred.

The Japanese make a paper to imitate leather, in which the surface has every appearance of a finished skin, with extraordinary firmness and elasticity, and it can be subjected to washing without any injury from the water. These pecularities are not so much due to the superior quality of the material, as to the mode of manufacture, the surfaces remaining intact, even when the paper is very thick, while with us paper of this kind soon loses its firmness, and the grain is impaired. Japanese leather paper is made extensively at Flangawa, near Yeddo, the capital of the empire.

Design for a Seaside or Country Dwelling.

The picturesque dwelling shown on the opposite page was erected during the past year, and is here published as likely to meet the wants of some of our readers who may intend building at the seaside or providing a permanent home for themselves.

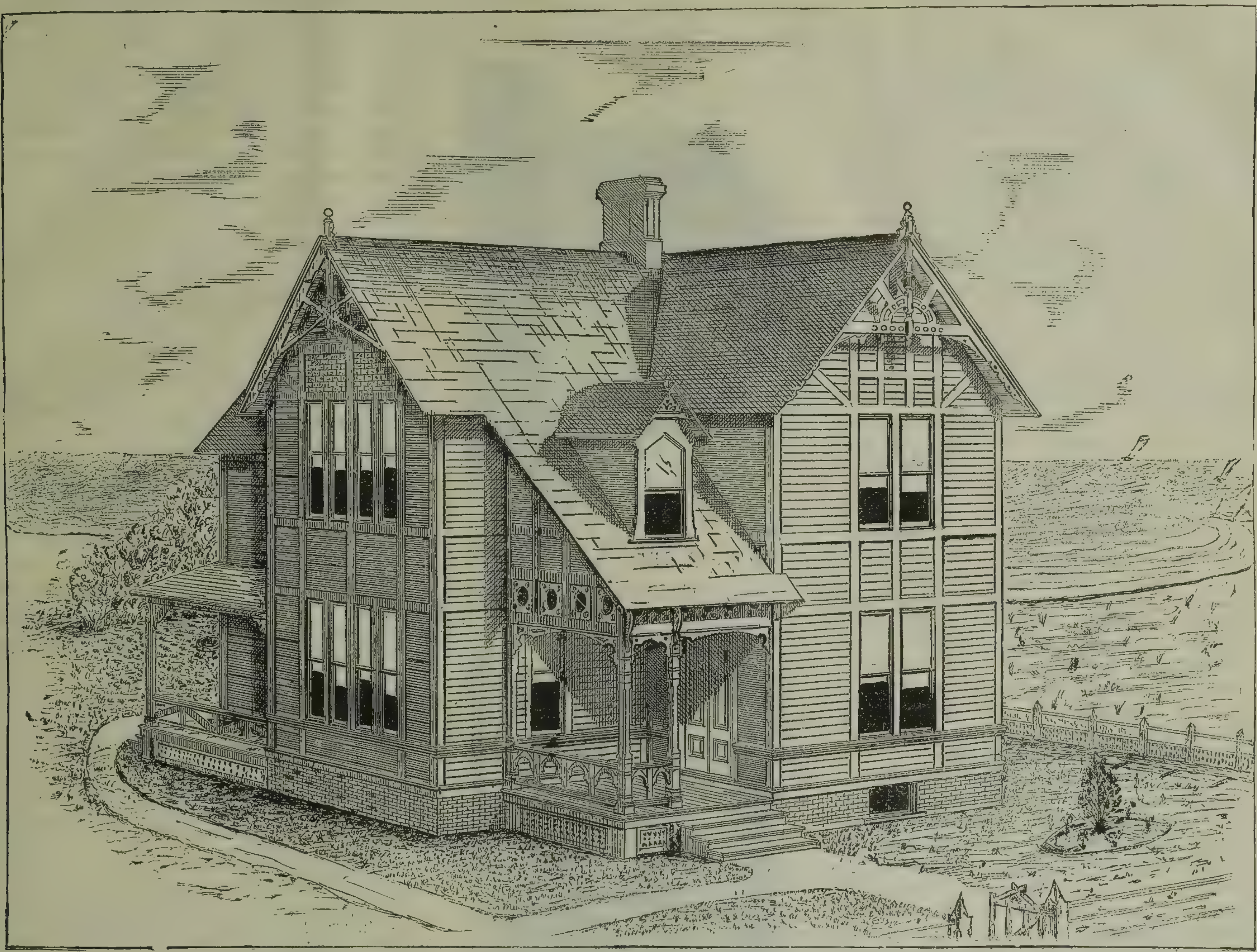
The interior arrangement is compact and admirable, the rooms being all of very generous proportions, while the large entrance hall, almost a room in itself, gives to the house an air of most pleasant hospitality; and opening as it does on a porch at each end, makes a delightfully cool resort from the glare on the porches or the naturally warmer air of the interior rooms. The window in the hall is fitted with outside blinds that are hung both on top and at the side. By this arrangement the blinds can be thrown out from the bottom, perfectly shading the hall, and this without excluding the air in the slightest degree.

The lower floor is taken up by the parlor—a spacious room, 17 × 20 feet; a sitting-room, 11 × 13.6 feet; the dining-room, 12 × 15 feet; and kitchen, 11.6 × 15.6 feet. From the kitchen, stairs lead to the cellar and to the second story. In the second story the bedrooms correspond in size very nearly with those of the rooms down-stairs; and with closets on this floor, it seems as though the architects have been lavish enough to please the most exacting housewife.

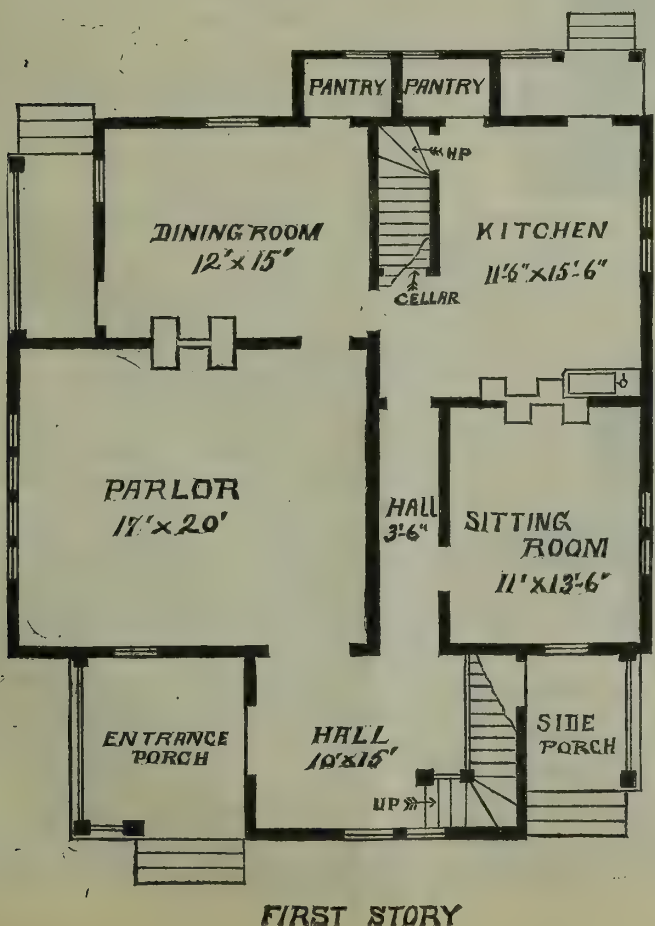
In place of one large piazza, the owner preferred having several porches, as shown; but as a piazza is deemed by many an indispensable portion of a seaside house, one can be easily provided here if desired, and in such manner as not to have the appearance of being an after-thought.

The cost of this house will vary according to location, but will be in the neighborhood of $3,500. The architects are in a position to furnish, for $2,000, all the material necessary for the erection of the house above the foundation and exclusive of white lead and tinning. The materials furnished include all the timber framed ready to be put in place, sash (glazed), blinds, doors, trimmings to doors and windows, flooring, stairs, finish to piazza, shingles, lath, studding, nails and other hardware—in short, all that will be necessary to erect the building, as stated, above the foundation. These materials will be delivered on car or boat in New York or Jersey City. By availing themselves of this arrangement, parties will have to contract only for the foundation and painting and the necessary labor on the building, an estimate for which can be readily obtained from the plans and specifications, which will be furnished with the materials.

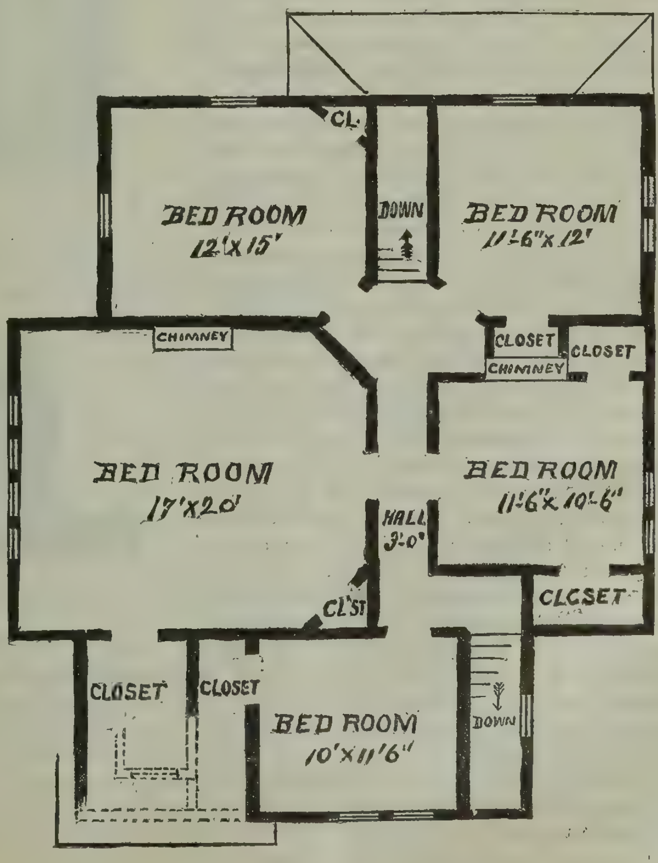
Any further information may be obtained by addressing the architects, Smith & Howe, 7 Warren street, New York.



DESIGN FOR SEASIDE OR COUNTRY DWELLING, COSTING $3,500.



FIRST STORY



SECOND STORY

An Improved Sash Balance.

Every one, at some time or another, has experienced inconvenience from the breakage of the cord, or from some other disorder of the arrangement of weights and pulleys in common use for balancing window sashes; and probably the thought has occurred to many when bothering about the readjustment of the troublesome device, that the one who would invent something simpler and easily rearranged in the event of its derangement, would deserve the blessings of the patient and long-suffering public, and would harvest a substantial pecuniary reward for his ingenuity.

We show in the accompanying engravings views of a practical and successful mechanical arrangement for meeting this "long-felt want." The device is known as the Anderson Sash Balance, and is designed as a simple and convenient substitute for the combination of weights and pulleys generally used for the purpose. The simplicity of this device is so apparent that it scarcely calls for explanation. It consists, as will be observed from an inspection of the cuts, of a spring placed within a cone (Fig. 1); the latter is attached to a metallic bracket, by which the whole device is fastened with screws in a recess within the window frame. The periphery of the cone is grooved and carries a cord, to which the sash is attached. Fig. 2 gives a section of a window frame, showing the balances in position for the upper and lower sash, the dotted lines representing the meeting rails of the sash. This combination of spring and cone, it is scarcely necessary to state, is adjusted in each case to the weight of the sash for which it is intended, so that it makes an equal balance. For extra heavy sash, such as are in use in large public buildings, two, or even more of such balances are attached on each side of the sash.

The advantages of this arrangement over weights and pulleys are manifold. It does away with the necessity of boxing the window frames, though it can be readily attached to any window, whether boxed for weights and pulleys or not. The cone affords a reliable guide for the winding and unwinding of the cord, which is less liable on that account to fray, and there is no weight to become jammed in the box, on which account the device is less liable to derangement than that in common use. When such derangement occurs, also, there is less trouble in readjusting it. While it has these special merits, the Anderson sash balance preserves all the advantages of the weight and pulley. When placed in the window, it is out of sight; it operates noiselessly; the sash can be readily removed without injury to the balance; when properly adjusted, the sash hangs at a perfect balance, requiring no exertion whatever to raise or lower the window; and each sash acts independently of the other, as where weights and pulleys are used. Ordinarily two balances are required for each sash, one on each side of the frame, each having the capacity of balancing one half the weight of the sash. Fig. 3 shows the modified form of the device designed for attachment to car windows.

These balances have been manufactured for the past ten years, in which time they have come into very general use throughout the country. While their simplicity and convenience have recommended them highly for use with the comparatively light sashes in dwelling houses and the like, they have been found to be peculiarly serviceable for hanging very heavy plate-glass windows, and they have been largely introduced with the utmost satisfaction into banks, court houses, hospitals and public buildings generally. The device is likewise especially serviceable in the case of old window frames, where weights cannot be applied without tearing the wall out to put in boxes at considerable cost and trouble. In such cases the balances can be put in at a fraction of the cost and trouble.

The following directions are given for placing the balances in the window frame:

Lower Sash.—Remove the sash strips, mortise a hole in the frame sufficient to admit the cone freely, and let the plate into the frame flush to such a point that the top of the opening in the plate will be in line with the meeting rail, the large end of the cone to inside strip, the plate running under it; the plate at the little end of the cone running ½ inch under the parting strip.

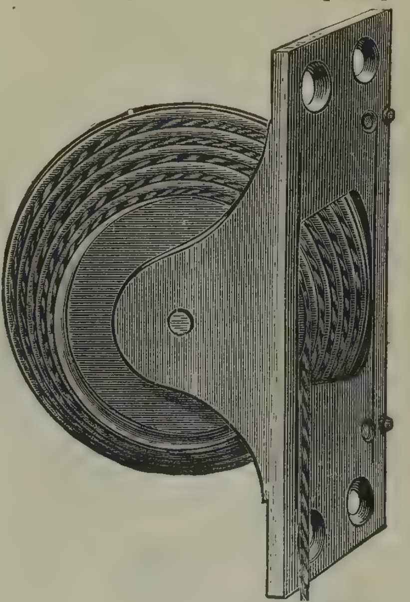


Fig. 1.—The Anderson Sash Balance.

With a ½-inch round plane groove the sash for the cord diagonally, commencing at the outside corner of the sash at the sill, and running to the inside corner of the sash at the meeting rail. The groove should be wide and deep enough to allow the cord to play freely without chafing. Attach the cord so close to the bottom of the sash, that when wound up the attachment will not ride on the cone.

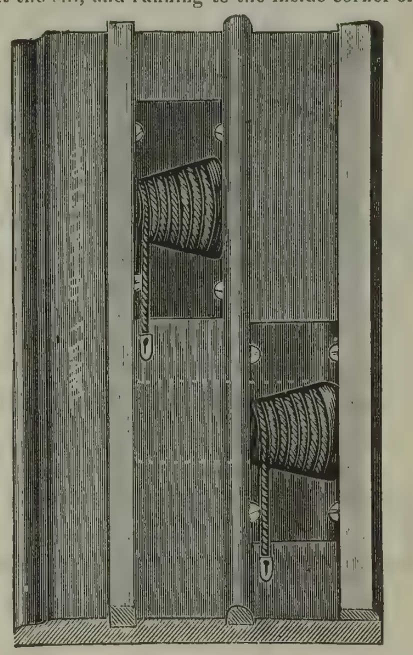


Fig. 2.—Section of Frame, with Balance in Position.

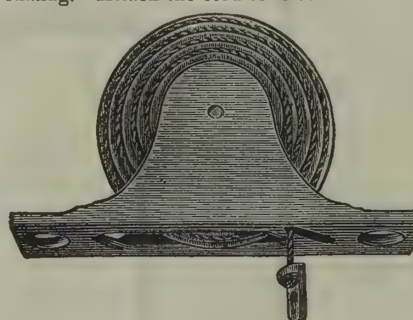


Fig. 3.—Car Window Balance.

Upper Sash.—Place the plate at the small end of the cone ½ inch under the outside strip, the plate at the large end running under the parting strip, and the bottom of the plate in line with the top of the plate of the balance for the lower sash. Groove the sash as above, from the outside corner at the meeting rail diagonally to the inside corner at the top rail, and attach the cord at such a point near the bottom of the sash that the cone may wind all but one inch of the cord. The balances are made "right" and "left," and should be placed accordingly. When ready to suspend the sash, place it on the sill of the frame in an upright position, and while supporting it with one hand, pull down each cord in turn, and hook the attachment on the screw, being careful not to allow the sash to raise until it is snug in its place in the frame.

The maker of this very useful device is Mr. O. K. Gardner, whose office and works are located at 28th and Railroad streets, Pittsburgh, Pa.

New Publications.

A Sketch of Dickinson College, Carlisle, Pa.; Including the List of Trustees and Faculty from the foundation, and a more particular account of the Scientific Department. By Charles F. Himes, Ph.D., Professor of Natural Science. Illustrated by Engravings and Photographs executed in the Laboratory. Harrisburgh: Lane S. Hart. 1879.

This admirable sketch of Dickinson College has, we feel assured, been a labor of love on the part of its author, who is a member of its faculty. Dickinson College is one of the oldest in the country, having been founded in the year 1783, just at the close of the war which secured the independence of the American colonies; and its history is closely associated with the development of higher education in America. Prof. Himes' historical sketch traces the progress of the college under the administrations of successive presidents, down to the present time. Of particular interest is the portion devoted to the Scientific Department. The college had, from the very first, taken cordial interest in this branch of learning, and was among the first to break away from the time-honored, inflexible, classical curriculum, by early establishing a course of scientific instruction parallel with the old classical one, leaving the student the option of selecting the one or the other after a certain grade in the collegiate course was reached. The wisdom of this policy has been fully shown in the steady growth in importance of the scientific department, which to-day is in a highly satisfactory condition. To meet the urgent needs of this branch of the college, which has expanded beyond the facilities that the present buildings afford, an earnest effort has been placed on foot, by the energetic head of the department, to secure its enlargement by the erection of a new building specially adapted for the purpose, and fitted with the most approved means, appliances and apparatus for scientific instruction and investigation. This effort is in a fair way to succeed, and the friends of the college will most probably witness its realization when the centennial anniversary of the institution is celebrated in the year 1883.

The friends and alumni of "old Dickinson" will find Prof. Himes' sketch of the college highly interesting, as it is the only connected history of the institution, so far as we know, that has ever been atttempted.

The book forms a duodecimo volume of 155 pages. It is handsomely printed in first-class style, and contains a number of photographs of the buildings, the earlier presidents, and of some historical apparatus of Priestley. A number of these are very creditable platinotypes executed in the college laboratory, and make a handsome appearance. The book should be in the hands of every friend and alumnus of the college.

The Leffel Mechanical News. A Journal of Manufacturing, Engineering, Milling and Mining. Published twice a month. Springfield, O., James Leffel & Co. Price $1 a year.

We are pleased to notice any evidences of substantial prosperity in any of our technical contemporaries, and take special pleasure in calling attention to the recent improvements made in our old acquaintance, *Leffel's Mechanical News*, which for years has been a welcome visitor among our exchanges. The publishers of this practical mechanical journal have given it a new dress of type, a new and attractive heading, and present it to subscribers with an increased number of pages and neatly pasted and cut. The *News* will make its appearance hereafter twice a month instead of once, as heretofore. We congratulate the publishers on the improved appearance of their useful and readable paper.

The Mechanical Engineer. An illustrated paper, devoted to Applied Mechanics and the Arts. Published semi-monthly, by Egbert P. Watson & Son, 5 Beekman street, New York.

The *Mechanical Engineer* is one of the latest candidates for public favor in the field of technical journalism. We have glanced over its pages with the curiosity that a new comer always excites, and have formed a very favorable opinion of its merits. Its articles, communications and editorials are eminently practical and useful in character, and the make-up of the journal very attractive. The subscription price of the *Mechanical Engineer* is $2 a year. We wish it the success its merit deserves.

OTHER PUBLICATIONS RECEIVED.

A Lecture on the Progress of the Works of Completion of the New improved Bed of the Danube at Vienna, and the Lessons Taught thereby; together with a description of the Catastrophe

produced by the Ice Gorge of 1880. By Sir Gustave Wex, Imperial Royal Ministerial Counsellor and Chief Director of the Improvement of the Danube at Vienna. With five sheets of drawings. Translated by G. Weitzel, Major of Engineers, Bvt.-Maj. U. S. Army. Washington: Government Print. 1881.

American Society of Civil Engineers. Instituted 1852. Transactions. The Strongest of the Bronzes. A Newly Discovered Alloy of Maximum Strength. By Robert H. Thurston, Member of the Society. Read January 5th, 1881.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of THE MANUFACTURER AND BUILDER. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2801) ANTHRACITE COAL DUST.—Is anthracite coal dust useful as a fuel? Can it be made permanently useful?—D. H., M.D., Lowell, Mass.

(2802) CHEMICAL NATURE OF GASOLENE.—I read in your journal recently a description of gasolene manufacture. Can you add to my information its constituent parts and their respective composition?—J. E. W., Philadelphia, Pa.

(2803) FLOW OF LIQUIDS THROUGH PIPES.—Is there any rule for the flow of liquids through small pipes, say ¼ or ½ inch?—J. E. W., Philadelphia, Pa.

(2804) CONCRETE FOR FOUNDATION WALLS.—What are the proportions for a concrete for foundation walls, and the best way to mix cement for laying bricks in a cistern?—J. E. W., Philadelphia, Pa.

(2805) OPEN-HEARTH STEEL.—What is meant by "open-hearth" steel?—E. E. Y., Dayton, Ohio.

(2806) INVENTION OF THE STEAMBOAT.—In your opinion, who is entitled to the credit of the invention of steam navigation?—R. S., Decatur, Ill.

(2807) FEEDING BY INJECTOR.—Is there a saving in fuel by feeding a boiler through an injector, with the steam cock wide open, or only partly open?—D. C. F., Keene, N. H.

(2808) TO TEST A STEAM GAUGE.—How can I test a steam gauge when there is no testing gauge to be had?—D. C. F., Keene, N. H.

(2809) ASHES UNDER A BOILER.—Is it better have the ashes under a boiler quite thick, or thin?—D. C. F., Keene, N. H.

(2810) TO REMOVE OIL THAT HAS DRIED UPON IRON OR BRASS.—Is there any way to remove oil that has dried upon iron or brass, except by scraping?—D. C. F., Keene, N. Y.,

(2811) TO BURN SCREENINGS AND TAN-BARK.—How can I burn coal screenings with tan-bark without their melting and clogging the grate?—D. C. F., Keene, N. H.

(2812) FEEDING A BOILER.—Is it better to have the feed to a boiler enter over the fire-box, or at the rear end of the boiler?—D. C. F., Keene, N. H.

(2813) TO REMOVE MORTAR STAINS FROM BRICKS.—Having marked the interest you take in getting reliable information for those inquiring, I am encouraged to ask for more. I have a red pressed-brick front. The bricklayers, in laying up the work, allowed the white mortar to stain the face of some of the brick. The front has to be left clean, with a white mortar joint—not colored down. What means must I employ to remove these stains? I would like to know what course of action bricklayers take in cleaning down fronts of a similar kind in New York.—S. B., London, Ont., Canada.

(2814) TO REMOVE RUSTED BOLTS.—Can you inform me how to remove bolts that have rusted in, without breaking them?—D. C. F., Keene, N. H.

(2815) WHITE FINISH ON CAST-IRON.—Can you give me a means of giving burnished cast-iron, such as lamp brackets, a finish like silver, nickel, or even white metal—a white finish such as the trade calls "extra gilt" by dipping in a blue vitriol bath?—H. M. R., Lewistown, Pa.

(2816) NICKEL-PLATING SOLUTIONS.—I find on page 74 of your April number for 1879, an editorial entitled "Judicial Mistakes in Nickel-Plating Lawsuits"; on page 77, "A Composition to be Used in Bath," (boiling), "To a dilute solution of chloride of zinc, 5 to 10 per cent. Nickel sulphate is to be added to impart a decidedly green color to it, and the solution is then heated to boiling in a porcelain vessel," etc.; and on page 90, "New Nickel-Plating Solution not Patented," sold by Messrs. Boynton, Wiler & Co., England. Is the use of such a bath as Boynton, Wiler & Co. offer an infringement of the nickel-plating patents? Is B., W. & Co.'s the best and simplest method where only a color coat is wanted? Where can B., W. & Co.'s solution be bought, or, if some other is better, where it can be got, and the name of it?—H. M. R., Lewistown, Pa.

(2817) REMOVING OLD PAINT.—Is there no simpler or quicker way of removing an old coat of paint than the common one of burning and scraping?—R. T., Northampton, Mass.

(2818) CAÑON OF THE COLORADO RIVER.—Where can I find a full descriptive account of the great cañon of the Colorado River, with explanation of the manner of its formation, etc.—J. P. L., Augusta, Me.

(2819) TO BLACKEN BRASS.—Will you please publish in your next a simple formula for blackening brass, and oblige.—T. D. M., Reading, Pa.

REPLIES.

(2801) ANTHRACITE COAL DUST.—Many efforts have been made from time to time by various inventors to utilize the immense heaps of anthracite coal dust that are accumulating constantly at the collieries in the coal regions and at the numerous distributing centers. These efforts have generally turned out to be dead failures, and only in a few cases have they proved to be even measurably successful. The Philadelphia & Reading Railroad Company, and other corporations largely interested in the mining and transportation of anthracite, have frequently given substantial aid to inventors for the purpose of furthering the success of their plans of utilizing these enormous accumulations of waste material, but in spite of the expenditure of large sums by these corporations, and by private parties, their efforts have, as above remarked, generally proved unsuccessful. Some twelve or fifteen years ago, a Philadelphia company erected expensive machinery near Nesquehoning, in the anthracite region of Pennsylvania, for the purpose of utilizing the anthracite dust, but after some time the works were abandoned. Later on, Mr. E. F. Loiseau, a Belgian inventor, devised what appeared to be a very practical process and suitable machinery for the same purpose, but after many and repeated failures to make the business commercially successful at Nesquehoning and at Port Richmond, Philadelphia, was forced to abandon the effort as a failure after sinking large sums of money in the venture. We are informed, however, that a company, known as the American Fuel Company, with extensive works at Rondout, N. Y., have been at work on a process of utilizing anthracite dust or "culm" with considerable success since the year 1876. Whether they are still at work or not, our correspondent may readily satisfy himself by writing to their address. All of the above named have endeavored to utilize the dust by mixing it with suitable cementing substances, and converting it by machinery, specially adapted for the purpose, into lumps of artificial coal. The trouble seems to be, not in the processes, but in the fact that they are too costly to compete at present prices with coal. This fact appears to have been the cause of the financial failure of almost every undertaking of this kind that has been ventured. The reputed success of the American Fuel Company in this field, therefore, we should be inclined to accept with a few grains of allowance, though the statements we have received to that effect have come on very excellent authority. By consulting the back volumes of the *Engineering and Mining Journal*, the "Proceedings of the American Institute of Mining Engineers," and the *Journal of the Franklin Institute*, this correspondent will find most or all of these processes described in full. Other plans of utilizing anthracite waste that are in successful use are worthy of mention, but they do not attempt to convert the dust into lumps of artificial fuel. One of these consists in pulverizing it to a state of fine powder and blowing it into the furnace, as it is fed from a hopper, by special machinery. Messrs. Woelply & Storer, of Boston, have been very successful in the introduction of plans of this kind. Again, anthracite dust is very largely used in and about Philadelphia for firing boilers, by mixing with a certain proportion of commercial coal and burning with forced blast, or with the aid of a steam jet or other devices. Mr. Wooten, an officer of the Philadelphia & Reading Railroad Co., has devised a special form of dust-burning furnace for the purpose of burning anthracite dust, which, so far as we have learned, has been applied to both stationary and locomotive boilers with very satisfactory results. Mr. Wooten can be addressed at Reading, Pa., should our correspondent wish to make special inquiries of him. From the above, our inquirer will have perceived that the utilization of anthracite dust with economical results, is successfully carried out. Enormous quantities of it, however, are still wasted, and any plan that could be devised for converting it profitably into artificial fuel, is very desirable. It is questionable, however, in view of the repeated failures of such attempts, whether they will be successful so long as the price of anthracite coal remains where it is. Should the market price of anthracite rise very greatly, as it will in years to come, with the gradual increase in demand, and the gradual increase in cost of mining it, there can be no doubt that such processes would prove commercially successful. We do not think the time has yet come when artificial coal can be generally manufactured and marketed in competition with natural fuel. We believe, however, there is room for much improvement of methods of utilizing anthracite waste in its present condition.

(2802) CHEMICAL NATURE OF GASOLENE.—As remarked in answer to a former query respecting gasolene, to which our correspondent alludes, petroleum is a highly complex substance, being a mixture of a great number of hydro-carbons; and the several commercial products, like gasolene, naphtha, kerosene, etc., obtained by its fractional distillation, are likewise not simple substances, but comprise a number of compounds which distil over within a certain range of temperature. We can best answer this question, therefore, by giving a brief account of the composition of crude petroleum, taking the product of the Pennsylvania oil wells as typical. As it comes from the wells, crude petroleum is a dark greenish-brown liquid, having a penetrating odor, and a specific gravity varying between 0.820 and 0.782 (water=1), equivalent to 40° to 48° Beaumé. It is chemically a mixture of a great number of hydro-carbons—compounds of hydrogen and carbon—the average proportion of the two elements in the mixture being:

Hydrogen	85 per cent.
Carbon	15 "
	100

These hydro-carbons differ from each other in volatility, and, as noted in our former query, some are so volatile as to evaporate rapidly at common temperatures, making it dangerous to approach an open tank of petroleum with a naked flame. Others, again, are much less volatile, some requiring a temperature of 700° to 800° Fah., to vaporize them. The lightest of these mixtures of oils are the most volatile, while the heavier oils have the highest boiling points, their volatility, therefore, standing in intimate relationship with their specific gravities. The same is true of their inflammability, the lightest oils being the most and the heaviest the least inflammable. As regards the exact chemical composition of petroleum, much remains to be done before the subject will be fully worked out. Pelouze & Cahours, Warren de la Rue, C. M. Warren and others, have succeeded in establishing one or more series of hydro-carbons homologous to marsh gas, which, in fact, form the bulk of the different varieties of petroleum; but, besides these, they contain oxygen compounds not yet studied or separated, and some of them contain also sulphur compounds, of which as yet little is known. The following is a tabulation of the hydro-carbons in petroleum as ascertained by Pelouze & Cahours:

Formula.	*Specific gravity.*	*Boiling point. Fah.*
C_2H_6	Gas forming.	... .
C_3H_8	Gas forming.	....
C_4H_{10}	0.600 below 32° F.	32°—40°
C_5H_{12}	0.628 " 62° "	86°
C_6H_{14}	0.669 " 60° "	154°
C_7H_{16}	0.699 " 60° "	198°—201°
C_8H_{18}	0.726 " 60° "	241°—245°
C_9H_{20}	0.741 " 60° "	277°—280°
$C_{10}H_{22}$	0.757 " 60° "	320°—324°
$C_{11}H_{24}$	0.766 " 60° "	356°—363°
$C_{12}H_{26}$	0.776 " 68° "	385°—392°
$C_{13}H_{28}$	0.792 " 68° "	420°—425°
$C_{14}H_{30}$	......	457°—464°
$C_{15}H_{32}$	......	491°—500°

C. M. Warren, as the result of his researches, affirms the existence in petroleum of two other series. One of these is homologous to marsh gas, but with boiling points different from the above series. The other series he refers to as homologous with olefiant gas. Without giving the formulæ for the members of this last series, called the ethylene series, we may note that Warren has detected three members $C_{10}H_{20}$, $C_{11}H_{22}$, $C_{12}H_{24}$, and paraffin. It is impossible, from the highly complex constitution of petroleum, and the fact that the commercial products separated are mixtures, and not simple substances having a definite composition, to state the chemical composition of gasolene and other light petroleum products with any greater accuracy than to say that they (rhigolene, gasolene, etc.) are composed of the lower members of the several series of hydro-carbons that constitute petroleum, while the heavier oils are mixtures of the higher members of the series.

(2803) FLOW OF LIQUIDS THROUGH PIPES.—The subject of the flow of liquids has been carefully studied by hydraulic engineers, and a number of elaborate formulæ determined to meet the various conditions occurring in practice. These formulæ are very complex, and our correspondent had better consult some of the standard engineer's pocket-books—Trautwine's, Haswell's or Nystrom's. For his information, we may add that Kutter's formula is believed to be applicable to pipes of all diameters, large or small. As given by Trautwine, it is presented as Kutter's general formula for the mean velocity in feet per second in pipes, aqueducts, canals, rivers, etc. This formula is the joint production of two eminent German engineers—Ganguillet and Kutter, but for convenience is generally called by the name of the last. In the formula, n is the coefficient for roughness for sides of pipe or channel. The *slope* is the quotient arising from dividing the fall in any portion of the length by the length of that portion. The *wet perimeter* is the length in feet found by measuring across the channel such parts of its sides and bottom as are in contact with the water. The *mean radius* is the quotient arising from the area of cross-section of the water divided by the wet perimeter. In pipes running full, it is always one-fourth of the bore. All the dimensions must be in feet. Then by Kutter's formula:

$$\text{Mean velocity in ft. per second} = \left\{ \frac{41.6 + \dfrac{1.811}{n} + \dfrac{.00281}{\text{slope}}}{1. + \left\{ 41.6 + \dfrac{.00281}{\text{slope}} \right\} \times \left\{ \dfrac{n}{\sqrt{\text{M. R.}}} \right\}} \right\} \sqrt{\text{M.R.} \times \text{Slope}}.$$

Table of n; or coefficients of roughness of wet perimeter:

.009 for well-planed timber.
.010 for glazed pipes.
.012 for unplaned timber, or unlined cast-iron pipes.
.011 for very smooth pipes.

The following rule, from the same authority, is approximately correct, and may be found serviceable, though it makes the discharge rather too small in large pipes, and too large in small ones. *Rule.*—Multiply the diameter in feet by the total head in feet. Call the product a. Add together the total length of the pipe in feet, and 54 times its diameter in feet. Divide the product a by the sum. Take the square root of the quotient, multiply this square root by the constant number 48. The product will be the first or approximate velocity of flow in feet per second; or, by formula:

$$\text{Approximate velocity in feet per second} = 48 \times \sqrt{\frac{\text{Diameter in ft.} \times \text{total head in ft.}}{\text{Total length in ft} + 54 \text{ diam in ft.}}}$$

(2804) Concrete for Foundation Walls.—No infallible rule can be laid down for the preparation of concrete for foundation walls, as so much depends on the quality of the cement used in the work. We can only give a few general hints based on some good examples. The concrete for the New York city docks, on Trautwine's authority, consists of, either English or Saylor's Portland, 2 of sand and 5 of broken stone (hard trap). At the Mississippi jetties, Saylor's Portland, 1; sand, 2.76; gravel, 1.46; broken stone, 5. In the foundations of the Washington Monument, at Washington, D. C., there was used, English Portland, 1; sand, 2; gravel, 3; broken stone, 4; and, according to government report, had a crushing strength of 155 tons per square foot when seven and a half months old. At Croton Dam, N. Y., Rosendale, 1; sand, 2; broken stone, 4.5. Slow setting cements are generally considered the best for concretes. Ramming of concrete, when properly done, consolidates the mass about 5 or 6 per cent, rendering it less porous and very materially stronger. The size of broken stone for concrete should not exceed 2 inches on any edge. General Gillmore, our best authority, states, with reference to the use of lime, that even in important concrete work in either air or water (provided the water does not come into contact with it until setting takes place), from one-quarter to one-half of the neat cement paste of the United States common cements may be replaced by lime paste without serious diminution of strength or setting qualities, and with decided economy. It retards the setting, which is often of great advantage, especially with quick setting cements, which at times cannot on that account be advantageously used without lime. From the above hints our correspondent can draw his own conclusions. To mix cement for mortar, a good rule will be to take 1 part by weight of good cement powder to 3 or 3½ parts of sand; mix in small quantities at a time, using just enough water to bring the mixture to a stiff paste.

(2805) Open-Hearth Steel.—The term "open-hearth" steel is applied to steel made in Siemens' open-hearth furnace, to distinguish it from the product made by the old cementation or crucible process, or in the Bessemer converter. The following will give a general idea of the method: The furnace or hearth in this process has usually a capacity of about 8 tons. Taking the manufacture of steel boiler-plate as an example, the charge would consist of a high grade pig iron, carefully selected with special reference to its freedom from phosphorus, sulphur, silicon, etc., care being taken that the total carbon percentage is not too high—a No. 3 foundry pig being about the right grade. This pig constitutes about 25 per cent of the entire charge. It is melted in the hearth and brought to a very high heat, when charcoal blooms, or other wrought iron of similar grade, previously heated to a bright-red heat, are then immersed in the bath and allowed to dissolve in it. These charges are usually from 600 to 800 pounds, and are introduced continuously every twenty or thirty minutes, until the carbon in the whole mixture is brought to the desired point, which, for boiler-plate, is from 0.10 to 0.20 per cent, and the silicon is reduced either by fusion or by chemical action to the minimum amount—say from 0.01 to 0.05 per cent. Tests are now made to determine the quality of the metal in the bath. This is done by taking out a small test ingot, which, after cooling in water, is broken and tested. The fracture gives a very good indication of the state of the charge. If in the judgment of the melter the metal is sufficiently refined, high grade ferro-manganese, previously heated, is now put into the bath, and the whole mass of metal thoroughly stirred, and then run out into a large ladle, from which it is poured into the ingot molds. These ingots are then rolled into plates in the usual manner. The above described process is substantially that followed in ordinary practice. The process allows of considerable latitude in manipulation, and different manufacturers doubtless pursue different methods of working.

(2806) Invention of the Steamboat.—With respect to such great and revolutionizing inventions as those of steam navigation, the electric telegraph and the like, it is impossible that a single man should bear the whole honor of the great achievement. In every instance of this kind, it will be found upon careful study of the history of the times involved, that many men contributed to the final success of a great invention by their individual labors. In the field of steam navigation, the names of Oliver Evans, John Fitch and Robert Fulton are the most prominent. Oliver Evans made experiments in this direction in Philadelphia as early as 1768. Fitch constructed and used a vessel driven by steam, with a paddle-wheel at the stern, on the Schuylkill in 1785; and in 1786 built a larger and more practical steamboat, which he tried on the Delaware, and which made eight miles per hour. In 1790, contemporary history tells us, Fitch had run a boat between Philadelphia and Burlington, N. J., to carry passengers, which was actuated by paddles at the stern driven by steam. For some reason, possibly because the times were not quite ripe for the innovation, but more probably because of the only partial success of his mechanism, Fitch's experiments and efforts to introduce steam navigation failed of success; and he died in 1798, as the popular histories tell us, "a broken-hearted man, owing to the want of popular appreciation of his inventions." It is generally admitted now, that while the inventors above named are entitled to honorable distinction for their contributions to the cause, the credit of having made navigation by steam a practical success belongs to Robert Fulton, an American (as were also the others), and a native of Little Britain, Pa. Fulton, who had resided some time in Europe for the purpose of completing his mechanical studies, is known to have launched a steamboat on the Seine at Paris, in the year 1803, in behalf of himself and Chancellor Livingston, our then minister to France. The strength of the boat had been miscalculated by the builders, and when the machinery was placed in her, she broke in two in the middle, and the whole concern went to the bottom. Nothing daunted by this mishap, Fulton fished up his machinery from the mud of the Seine, and in the fall of the same year placed it in another vessel 66 feet long and 8 feet wide. This vessel had paddle-wheels, but moved so slowly (only 3 miles an hour) that it was generally pronounced to be a failure. But the experience gained was of much value to Fulton, who returned to his native country and continued his experiments there. His associate, Livingston, shortly afterwards obtained a patent from the State of New York for the right to navigate its waters by steam for twenty years. Then followed the launching of "The Clermont" under Fulton's directions, in 1807, on the East River. She was 160 tons burden, and was supplied with side paddle-wheels. From this event we may date the actual practical success of steam navigation, which from that time came to stay. We can best tell the story by quoting what history has recorded. Speaking of "The Clermont," we are told: "A more astonished crowd of human beings had never collected on the shore of Manhattan Island since the days when the open-mouthed red man saw Hendrick Hudson sail up the bay and cast anchor off shore, than were assembled the day 'The Clermont' made her first trial trip. Everybody had said the experiment would fail. The boat had been called Fulton's Folly, and the whole scheme had been the standing joke of the town. 'The Clermont' had not gone a hundred yards from the shore, however, before the multitude which was looking on, became a prey to the liveliest surprise and admiration, which almost deepened to alarm as they heard the racket of her machinery and the terrific splashing of the water, and saw the fire and smoke pouring out of her smoke-stack. The boat 'walked the waters like a thing of life,' and left the overwhelmed spectators behind her at a speed of five miles an hour. She made that first trip to Albany, against the current, in 32 hours, scaring the boatmen and farmers along the Hudson dreadfully, especially at night, by her roaring and her fires. The vessel made regular trips to and from Albany, and was joined in the same year by a second boat called the 'Car of Neptune,' constructed by the same builders, and later by a third called 'The Paragon.' The two latter were of 300 and 350 tons respectively. Steam navigation was now a success—complete, practical and triumphant, and the achievement took place in the New World through the energy and genius of Americans alone. It was not until 1812, that 'The Comet of the Clyde,' the first trading steam vessel of Europe, was launched and taken out for a trial trip." His native State has lately paid a just tribute to Fulton's distinguished achievements by selecting him as one of the two Pennsylvanians whose statues she contributes as her quota to the company of American worthies whose effigies (two from each State) are placed in the old Hall of the House of Representatives in the Capitol.

(2807) Feeding by Injector.—This question is too vague to answer. It may not necessarily be uneconomical to feed with the cock full or partly open, as the conditions for obtaining the best results will depend on the size and capacity of the injector and the amount of work it is called on to perform. We can only lay down the general rule to feed regularly and often, keeping the water-level nearly constant, and put the feed in as hot as possible.

(2808) To Test a Steam Gauge.—To test a steam gauge when there is no testing gauge to be had, by which to compare it, is a question we cannot answer. By using lengths of gas pipe and a column of water (quicksilver could not be used, as it would amalgamate and ruin the gauge), it would be practicable to test it to a limited range, say up to 20 or 30 pounds. But considering how much trouble this would be, and the fact that a tolerably reliable gauge can be bought for $4 or $5, it would hardly be worth the time and labor.

(2809) Ashes Under a Boiler.—The less the better. Fires should be kept as clean as possible, so that there may always be a bright glow in the ash-pit. By attention of this kind, the best heating effect of the fuel will be obtained. In internally fired boilers, the presence of much ashes may give rise to serious results by corrosion, as slight leakages from the tubes may leach out the alkalies from the ash, which would act destructively upon the metal.

(2810) To Remove Oil that has Dried upon Iron or Brass.—To effect this without scraping, a number of plans can be suggested. Ammonia (spirits of hartshorn), soda or soda lye, spirits of turpentine, a mixture of alcohol and ether, or benzine (petroleum spirit), may be used, and any one of them may be found to answer the purpose. The use of alkali (ammonia or soda) will probably prove the most effective; but it must be used cautiously, on account of its corrosive action, and afterwards thoroughly removed.

(2811) To Burn Screenings and Tan-Bark.—From the nature of this question, we infer that our correspondent has attempted to use the screenings of bituminous or coking coal with tan-bark, which is a difficult operation. If we were called on to recommend and guarantee a first-class mixture for clogging a grate, we know of none that would fill the bill more effectually than this one. Anthracite screenings and mixtures of such stuff with tan-bark and other refuse combustibles, are successfully burned in furnaces of special construction, or with the use of artificial draft. A steam blower for this purpose was described in our April number. Much refuse of this kind can be successfully and economically utilized by spreading it from time to time on a good bed of burning coal. With the Jarvis furnace-setting, which our correspondent will find described on another page, it is claimed that such mixtures can be successfully burned. We would suggest to him the propriety of communicating with this company, whose address we give. The agents will no doubt promptly give him specific answers to any questions that he may ask.

(2812) Feeding a Boiler.—On general principles, we should say it would be best to feed at the rear end. But the question cannot be answered absolutely, as something would depend on the type of boiler and the manner of feeding, whether by pump or injector, cold or hot. It is most desirable to feed as hot as possible, and always with the circulation. Where cold water is fed, it would be objectionable of course to feed over the fire-box, as the highly heated plates would be subjected to unnecessary and severe strain by reason of repeated contraction and expansion. In the last case, it would be best to feed at the rear in as fine a jet as possible, and with the circulation.

(2813) To Remove Mortar Stains from Bricks.—We are told that bricklayers make use of spirits of turpentine, and also of vinegar, for the purpose of removing mortar stains from pressed brick fronts, the materials being carefully applied with a sponge or rag. We should say that any acid, applied in the above manner, in very dilute form, would answer the purpose. Vinegar being a very dilute acetic acid, is probably as good a recipe as can be given.

(2814) To Remove Rusted Bolts.—To remove bolts that have rusted in, without breaking them, the most effective remedy that we know of, is the liberal application of petroleum. It rarely fails to accomplish the work. Care must be taken that the petroleum shall reach the rusted parts, and some time must be allowed to give it a chance to penetrate beneath and soften the layer of rust, before the attempt to remove the bolt is made.

(2815) White Finish on Cast-Iron.—The method on page 77 of our April number for 1879, describing a process of securing a white coating on cast-iron and other metallic surfaces, by immersion and boiling, without the aid of a batttery, is probably the simplest and best method of effecting this correspondent's purpose, since it avoids completely the raising of the question of infringing on any one's patent; and the results obtained are said to be very satisfactory.

(2816) Nickel-Plating Solutions.—We do not think that the use of such a solution as that of Boynton, Wiler & Co. would infringe on the United Nickel Company's patents. By consulting our editorial in last month's issue of this journal, our correspondent will find our opinion of the nickel-plating litigation fully expressed. We regret that we cannot furnish him with the address of Messrs. Boynton, Wiler & Co., but this he can doubtless obtain without much difficulty by addressing a note of inquiry to the editor of the London *Engineering*, *Iron*, or some one of the leading technical journals of England, or through some private correspondent. There are, however, a number of American processes that will give quite as good, or, perhaps, better results than the solution of B., W & Co. That of Pendleton, referred to in the late decision of Judge Blatchford, is one of them, which is acknowledged to give satisfactory results, and has just been decided to be no infringement. It appears to be the simplest process with the use of the battery that has been thus far proposed. Another process of giving a silvery-white coating with the battery, and which would be free from the objection of a possible infringement, is the aluminum-nickel plating solution prepared by the Pennsylvania Nickel Works, Canal and Amber streets, Philadelphia. This solution deposits, with the battery, on iron, brass or copper surfaces, an alloy of aluminum and nickel, which is claimed to present a silvery-white surface susceptible of taking a fine polish, and which is very permanent and indifferent to atmospheric influences.

(2817) Removing Old Paint.—It is doubtful. We can make the following suggestion, which our correspondent can try if so disposed, and which will do the work perhaps with less trouble. It is this: Make a mixture of 1 part (by weight) of pearlash (or sal soda) with 3 parts of quicklime, by slaking the lime in water and then adding the other ingredient, making the mixture about the consistency of paint. Lay the above mixture over the work required to be cleaned, using an old, worthless brush for the purpose, and let it remain on over night. The paint can then be readily removed with a scraper.

(2818) Cañon of the Colorado River.—The most complete work on this subject, is a quarto volume entitled "Exploration of the Colorado River of the West, and its Tributaries," by J. W. Powell, published under the direction of the Smithsonian Institution, Washington, in 1875. Perhaps the Representative or Senator of your district could command a copy of this work for you if you would write to him about it.

(2819) To Blacken Brass.—For the purpose of blackening brass, the following recipe is recommended on good authority: Dissolve 30 parts of carbonate of copper in 250 parts of water of ammonia, and add 500 parts of water. The brass objects to be blackened should be suspended in the liquid from a brass or copper wire. The coated objects should not be polished with emery, but rather with an oiled rag.

THE MANUFACTURER AND BUILDER.

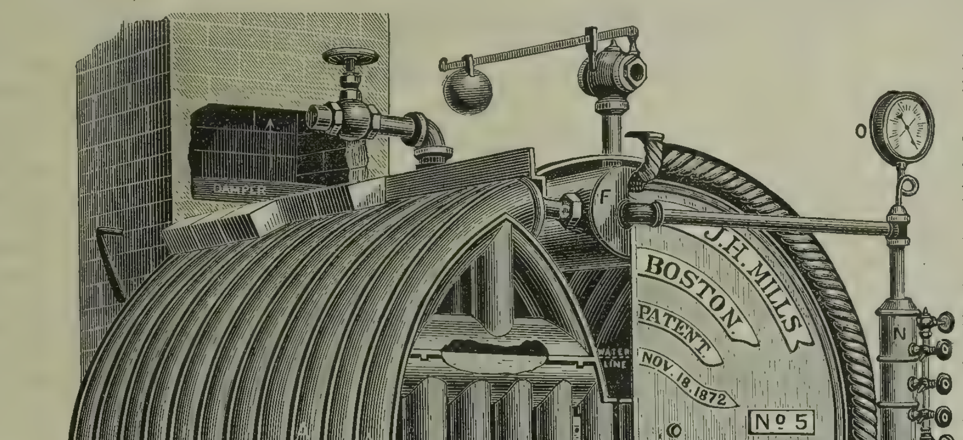
Vol. XIII.—No. 6. JUNE, 1881. THIRTEENTH YEAR.

The Mills Safety Steam Generator.

Many of our readers will recognize, under this title, a peculiar type of sectional boiler of cast iron, which has made itself very favorably known to steam users throughout the country. The adaptability of cast iron for constructions exposed to such constant and severe strains as steam generators, has been the subject of much discussion in the past among mechanical engineers. But the question, we think, may now be considered as beyond the pale of discussion, for the reason that the crucial test of successful practice has long since definitely settled the points in dispute. So long ago, in fact, as the year 1867–68, so eminent a body as the Committee of Science and the Arts of the Franklin Institute of Pennsylvania, placed themselves unqualifiedly on record as approving of the use of cast iron for this purpose, and crowned with their highest award the inventor of a form of sectional steam generator of this kind. Aside from this, the fact that such generators have been for years in service with satisfactory results, would itself be a sufficient answer to any objections raised upon this point.

As regards strength, or the ability to withstand a bursting strain, it is hardly necessary to remind our readers that in this respect the factor of proportion enters quite as importantly into the consideration as the factor of material; and that there are two ways in which we may increase the strength of a hollow vessel; first, by increasing the thickness of its walls, and second, by diminishing its diameter. By the adoption of this principle, cast iron, though it does not possess as high a degree of tensile strength as wrought iron, is relieved of any objection that could be urged against it on the score of sufficient strength, and this too without such increase of the thickness of the metal as to materially interfere with the free transmission of heat.

With these preliminary remarks, we are prepared to offer a description of the peculiar form of sectional steam generator of cast iron referred to at the outset of this article. The fundamental principle in the construction of the Mills steam generator was to realize in practice the idea of a sectional generator, each section or division of which should be distinct and complete in itself, and not dependent upon another portion for its operation. In reality, therefore, each of the sections of this apparatus comprises within itself all the elements of an entire generator, including a fire-chamber and grate surface, having its own water supply and steam delivery, receiving its water and discharging its steam without regard to the other members of the system. The generator, therefore, consists of a series of such members, which, when aggregated, serve by their construction and disposition to form a connected fire-chamber for the proper and effective circulation of the heated furnace gases. The disposition of the several members comprising the Mills generator will be readily seen by consulting the accompanying engraving. The makers call special attention to the flanges cast on the two sides of the pipes, which, being placed side by side, form the wall of the furnace against which the fuel rests; and also the pockets for the supply of air to the burning coal. These flanges, as well as those provided for guiding the furnace gases, are protected from the destructive action of the heat by the water contained in the pipes of which they form a part. The construction, in fact, is such that the entire furnace, including grate bars, is protected from the destructive action of excessive heat by the water contained in the pipes on which the flanges are cast and on which the grate bars rest. No bricks or other destructible material enters into the construction of the furnace, and the outside wall is simply required for retaining the combustion products and preventing the radiation of heat.



THE MILLS SAFETY STEAM GENERATOR.

By consulting the adjoined engraving, these peculiarities of construction will be very plainly seen; A A represent the independent members of the steam generating system, the connecting arm crossing beneath the grate bars. The furnace chamber proper is represented by O O, and the grate bars by D D. Each member of the system is provided with the air pockets N N which serve for the introduction of air independent of that admitted through the grate, by which device an abundant air supply is assured to the body of the fire chamber, and a corresponding completeness of combustion. The steam space is represented by O O, and the steam drum by F. The external connections are principally the following: G is the feed drum; H H, pipe connections to drums; K, drop plate; N, stand pipe and water gauge; M, cleaning doors. The arrows indicate the direction of the furnace products.

The meritorious features of the foregoing system of construction will appear in detail further on. In this place it will suffice to say that these generators have been in actual service for a number of years, and have acquired an excellent reputation for durability, convenience of management, and economy as measured by steaming capacity.

The following record of a trial test of a Mills safety steam generator, made under the direction of Mr. M. M. Stimson, Chief Engineer of the Grand Rapids and Indiana Railroad Company, will serve as an example of the performance of this type of steam generator. The generator tested was used for heating the new office building of the company at Grand Rapids, Mich. The test was made in December, 1880. The data and results are given below.

"The generator was fired as usual, and steam was allowed to flow off into the atmosphere without press-

ure. The coal used was anthracite, egg size, and of rather poor quality. The temperatures were taken from carefully graduated thermometers. The temperature of the steam was ascertained from a thermometer having its bulb inserted in the steam pipe.

TABULAR RESULTS OF THE TRIAL.

Hight of generator	7 feet 9 inches.
Width of generator	7 feet.
Depth of generator	8 feet.
Heating surface	400 square feet.
Mean temperature of steam	212° F.
Mean temperature of feed-water	40° F.
Mean temperature of fire-room	40° F.
Mean temperature of flue at chimney	228° F.
Total coal used in pounds	1,000
Ashes and waste in pounds	144
Total combustible in pounds	856
Water evaporated in pounds	9,000
Water evaporated from and at 212°	10,530
Water evaporated in pounds per pound of coal from the temperature of feed, in pounds	9
Pounds of water evaporated per pound of coal from and at 212°	10.53
Equivalent evaporated from and at 212° per pound of combustible	12.3
Ratio of heating surface to grate surface	36.3
Square feet of grate area	11
Pounds of coal per sq. ft. of grate per hour	9.9
Horse-power of generator	33

The report of which the above is an abstract of the essential parts, is duly signed and certified.

From what has preceded, our readers will be able to judge how fully the makers' claims to superiority for this steam generator are justified. They are, briefly condensed, as follows: The mechanical construction of this generator in one complete, homogeneous casting, and the form and disposition of the pipes, grouped in such a manner as to be subjected to very uniform and equally distributed heat, are claimed to be notable points of superiority over other forms of sectional boilers. The form and diameter of the pipes are such as to insure the greatest strength with the least weight of material, and their arrangement provides very effectually against the undue and unequal expansion and contraction of any part, an objection which seriously hampers the usefulness of many forms of sectional boilers.

Another excellent mechanical feature exhibited in this generator, is the manner in which the sections are united, the joints being located where the flame of the furnace cannot act upon them. The construction of the furnace, previously described, is worthy of special notice; as likewise the provision which is made for effecting a complete combustion of the fuel, the air supply being carried in separate channels, not only to the fuel on the grate, but also to the furnace gases in all parts of the fire space, so distributed as to mingle thoroughly with the unconsumed furnace products, and effect their complete combustion, with corresponding economy as regards fuel consumption and steaming effect. Again, the arrangement of nearly all the heating surface of the generator in a vertical position, is the most convenient and practical that could be devised for free vaporization, since it presents the water to the furnace gases in a connected series of small columns, from which the steam may escape unobstructed by cross currents, as rapidly as it forms, while the scale-forming impurities and sediment contained in the water subside below in the cross-pipe beneath the fire, from which they may be blown out or cleaned out.

With regard to the important question of safety, this generator, from its construction, possesses the essential conditions which are generally admitted to be necessary to avoid disastrous explosions, and of which the sectional boilers as a class are typical representatives—*i. e.*, in the separation of the water and steam into small subdivisions, so that a rupture will affect but a single section of the subdivided structure. This desirable feature the Mills generator shares in common with other generators of the sectional type. As regards strength, which is an important element of safety, the construction of the essential members of the system in the form of cylinders of small diameter obviates any objections that might be urged against the use of cast iron, since in this form the strength of the portions of the structure subjected to strain, without undue thickness of metal, is far beyond any demands that will be made upon it in service.

A convenient feature in the construction of this generator which deserves to be mentioned, is the facility with which it may be increased by the addition of new sections, which can be done readily and without specially skilled labor.

Summing up the foregoing details and conclusions, we have in the Mills steam generator an apparatus possessing marked peculiarities of construction, which realize to a notable degree in practice the desirable features of safety, durability in service, and high evaporative duty.

The manufacturers of this generator are the H. B. Smith Company (A. Mercer, agent), 8 Dey street, New York, who may be addressed for additional particulars. The factory of the company is at Westfield, Mass.

The Manufacturer and Builder.

A MONTHLY JOURNAL

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 6. THIRTEENTH YEAR.

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The Electrical Railway.

In referring lately to the experimental electrical railways constructed by Messrs. Siemens and Halske in Germany, and by Mr. Edison in this country, we took occasion to speak in favorable terms of the future possibilities which the general introduction of electrical motors might realize so soon as the practical success of the new system should be demonstrated from a technical and economical standpoint, in revolutionizing the present crude and unsatisfactory methods of transportation in mining and agricultural districts, and in cities, the existing modes of transporting passengers and goods.

On the strength of what it had been shown to be possible to accomplish in this direction with the experimental apparatus of the gentlemen above named, we ventured the opinion that the general introduction and adoption of the electrical railway for a variety of uses, was simply a question of time. As an evidence of the reasonableness of this prediction, it was mentioned that Dr. Siemens had laid plans before the municipal authorities of Berlin for a practical working electric railway, which were reported to have met with approval. Dr. Siemens' plans were designed for passenger traffic and for the postal service, the last being intended as a substitute for the pneumatic system in use in that and other European cities.

Since writing the article in question, Messrs. Siemens and Halske having secured the approval of the authorities, have constructed and put in operation a railway actuated by electricity, between Lichterfelde and the Cadettenhaus, six miles from Berlin, which, from accounts that have appeared in the public press, fully realizes every anticipation of its originators, and which, should the anticipations respecting its efficiency and economy in operation be found to be justified after a reasonably extended trial in public service, cannot fail to give a powerful impetus to the general introduction of this and similar systems throughout Europe and in this country.

The news respecting the ceremonies attending the formal opening of this novel railway is substantially conveyed in the following telegraphic dispatch published in the London *Evening Telegram* of May 13th. The correspondent of that journal telegraphs from Berlin that "Messrs. Siemens and Halske, two well-known electricians, invited members of the municipality and press to take part in the trial of their new electric railroad, which runs between Lichterfelde and the Cadettenhaus, six miles from Berlin. The trial was an entire success. Every praise must be given to these electricians, who had not only to work out the most difficult of scientific problems, but also to contend with the most stringent rules which German officialism thinks fit to exercise on such undertakings. The trial was made in a simple tram car, with an electric battery entirely concealed between the wheels. It was connected through the rails on which it ran with the principal machine at the station. The rails are 39 inches apart, and exactly resemble those of an ordinary railroad, the gauge being narrower. The great-

est speed obtained at the trial was 18 English miles an hour. Dr. Siemens has proved that, if necessary, far greater speed could be obtained, but this was not allowed by the German police authorities. The fact is, that the officials here hardly know how to deal with this wondrous invention. They seem afraid of it, and do not know whether to place it under the tramways or railroads act. However, for the present they choose to consider it, as our Atlantic cousins would say, a simple horse-car, and for public use it will not be allowed to proceed at more than 9 miles an hour. The railroad will be opened to the public on the 16th of May."

The city of Berlin, from the foregoing account, is entitled to the credit of having introduced the first electrical railway for public service. The results of the practical operation of this pioneer road will be looked for with the greatest eagerness by those who are specially interested in extending the technical applications of electricity, and by the intelligent public generally everywhere.

In conclusion of this brief notice of the highly interesting enterprise of Messrs. Siemens and Halske, we may briefly recapitulate from our earlier remarks on the same general subject some of the more prominent features and advantages of the electrical system for railways. Should the success of the electric railway, from technical and economical standpoints, be once assured —of which fact the experimental trials already made leave little room to doubt—we may reasonably expect to see the system extensively introduced in the near future for mining and agricultural purposes, and in our cities for the transfer of passengers and goods.

For the purposes above named, and doubtless for others, the advantages of electricity as a motive power over steam and animals, is too pronounced to admit of question, and its practical adaptability once established, the general adoption of the electric method of propulsion for hauling ores and minerals, for plowing and other agricultural work, and in cities for the transfer of passengers and goods, and for postal and package service, will be simply a question of time.

We anticipate that the electric railway will grow speedily into popularity on the strength of its introduction in a few prominent localities, where its advantages over steam and horses, in the absence of noise, freedom from liability to many forms of accident now unavoidable, and from the annoyances of flying sparks, cinders, grease, and the other offensive and dangerous accompaniments of our present elevated steam roads, would strikingly demonstrate themselves; and should the anticipations of the advocates of the electric railway for our cities, as a substitute for the surface horse roads, and for the transaction of much of the package and freight traffic over thoroughfares now thronged with vehicles, be realized, the single advantage that would be gained in the improvement of the sanitary condition of our cities, in ridding us of the vast bodies of filth with which our streets are daily littered, can hardly be overestimated.

Substitutes for Coal in the Household—The Fuel of the Future.

The introduction of some practical, simple and economical method of providing dwelling houses with ample supplies of heat for warming, cooking and other domestic purposes, as a substitute for the present universal use of coal, is one of the reforms in domestic economy which the near future may have in store for the sorely-tried housekeeper of to-day. The demand for substantial reform in this direction is loud and imperative. The use of solid fuel, in the form of coal for example, in the manner in which we consume it in our stoves, heaters and ranges, is probably as extravagant, wasteful, troublesome, dirty and generally unsatisfactory a method of providing this necessary convenience of the household as could be devised. In addition to the annoyance and expense of having coal hauled from the yards and dumped into our cellars, from which it must be dragged laboriously to every story of the house where it is needed, we must at present suffer the annoyance of knowing that we buy at the outset from 5 to 10 per cent of worthless material in the form of ash, that must afterwards be laboriously gathered up and conveyed to the barrel or box provided for its reception, and that we blow out at our chimneys about three-quarters of the heat that is given off in its combustion. To those who have given the subject any thought, therefore, the designations—wasteful, troublesome and dirty, are not too strong in characterizing the use of coal in the household.

Savants and inventors have long since appreciated the lamentable deficiencies of the present method of supplying heat for the household, and have suggested several plans of reform. These plans, some of which have had measurable success in practice, all proceed upon the principle of supplying the heat from some central source of supply. The methods proposed involve either the use of steam, superheated water or fuel gas. In all of these plans, the heating agent is supposed to be generated at some centrally located station, from which it is to be distributed by suitably protected pipes through the streets and into the houses where it is to be consumed.

We mention steam first on the list of substitutes for the use of solid fuel in the household, because of its prominence, on account of its present successful and very general use for the heating and warming of buildings. Thus far, however, its use has been generally confined to the warming of large buildings used for business purposes, and only to a limited extent has it been introduced into private dwellings. The success, however, attained by Mr. Holly, of Lockport, N. Y., in devising and putting into practical operation a system of heating extensive areas—whole towns, in fact—by a system of steam heating, the heating agent being generated at central stations, and from there distributed, has fully demonstrated the practicability of the general adoption of steam for the warming of dwelling houses as an economical substitute for coal. On the score of safety, as the generators are located at a distance, there can be no valid grounds for objection; while on the score of convenience, the use of steam is infinitely superior to coal. In one respect, however, it apparently fails to fully meet our domestic requirements. It cannot, or at least has not yet, been made practicable for cooking purposes. This requirement could probably be met by the construction of suitable ovens for retaining the heating agent, and by the use of steam at sufficiently high temperature. But it must be remembered that many of the operations of the kitchen require so high a temperature that the steam would have to be supplied under enormous pressure, a condition that would materially increase the element of danger in its use, and which would practically render it unsuited for warming, for which steam of moderate pressure is found most suitable. Steam, therefore, does not entirely meet the requirements of a domestic heating agent.

The use of hot water has been suggested for the same purpose, the best known plan of this kind being the Prall system for transmitting heat by means of pipes carrying water superheated up to about 400° to 425° Fah. The water is superheated in boilers located at central sections, and is distributed in the same manner, and with similar precautions against loss of heat by radiation and conduction, as with the steam heating systems. The Prall system, which, we are informed, is about to be tested in practice in this city—its representative having secured the necessary official privileges for the purpose—contemplates the division of the city into a number of districts each of a square mile in area. Each of these will have its central station (with its battery of furnaces, boilers, superheated water tanks and force pumps), where the heat will be generated, stored up in the water, sent through the street mains, and delivered by suitable distributing pipes into every house choosing to receive a connection with the street main. In the house the pipes divide, one set branching into the kitchen for cooking purposes, and another into and through the rest of the house for warming. After making the circuit of the house, the water is returned through a separate line of pipes to the reservoir, thus making a complete circuit.

We have no opportunity as yet of noting the success of this plan, since it has not yet gone into practical operation. We have no desire to anticipate the result, but from what we have learned respecting it, we should incline to the opinion that the use of water under such high pressures as is contemplated, would meet with objection on the score of safety, and might be found troublesome to manage on the scale on which it is designed to operate the system.

The third plan—unquestionably the plan of the future—consists in the production of gaseous fuel, at central stations, and its distribution to and through our houses. The possibilities of fuel gas made a profound impression upon observing and practical men some years ago, when it was demonstrated that water gas, produced by the mutual interaction of steam and carbon at high temperatures, could be made in immense volumes at very trifling cost. The resulting gaseous product of this reaction, consisting substantially of hydrogen and carbonic oxide, furnishes a fuel as nearly perfect as can be imagined. Both ingredients are highly combustible, yielding an intense heating effect when ignited, and the products of combustion are gaseous.

By the adoption of water gas in our houses for cooking and warming, the existing contrivances can be utilized with little alteration, and as much or as little heat as may be required can be turned on at pleasure. When not required, the fire can be extinguished by the simple turning of a stop-cock. It gives complete exemption from the trouble, dirt and wastefulness of coal. Our fires will not need to be kept up over night winter and summer, as they now are, because of the trouble of making them up fresh in the morning. The gas fire can be made in an instant, and extinguished as quickly when it has served its purpose, and its heating effect can be controlled to a nicety for hours at a time. By the admission to the product, at the stations, of a trifling percentage of naphtha, or some one of the petroleum products, to give a sensible and penetrating odor like coal gas, so that its leakage may at once be detected by the smell, it will be as safe and as completely under control as the latter.

It is a subject of surprise to us, in view of the perfect adaptability of fuel gas for domestic purposes, that it has not already found its way into general use. We are aware that many difficulties had to be overcome before the manufacture attained its present economical and practical shape; but now that this essential has been successfully accomplished, we look for active measures on the part of the friends and advocates of fuel gas, with a view to its speedy introduction into our towns and cities. It commends itself by every consideration of convenience, comfort and economy, and any serious effort looking to the accomplishment of this reform will be warmly welcomed and seconded by the intelligent public.

A Very Narrow Gauge.

The most remarkable narrow gauge railway in this country, or perhaps in the world, is the 10-inch gauge road running from North Billerica, Mass., to Bedford, a distance of 8½ miles. The road-bed is well and substantially built. There are eleven bridges on the road, one of them over 100 feet long. The rails weigh 25 pounds to the yard. The cars and engines, though small, are handsomely proportioned. They are supported very low down, to give them stability. The cars have a center aisle, with a seat for one passenger on each side (instead of two). Each car provides seats for 30 passengers; they are provided with closets and a water tank, are heated by steam, and furnished with all other customary modern improvements. They weigh but 4½ tons—an ordinary passenger car weighing about 18 tons. The engines weigh about 8 tons, and, to give greater adhesion, are placed behind the tender. They draw two passenger and two baggage cars, at a speed of 20 miles per hour.

Improved Hoisting Engines.

The Lidgerwood Manufacturing Company claim to have produced in the hoisting engine of which we give herewith an illustration, a most simple, durable, effective and economical engine for all general hoisting purposes, being made from entirely new patterns and designs, and from an experience of many years in this particular branch of business.

All the wearing surfaces have been greatly increased, thereby reducing the friction very materially, and at the same time increasing the durability; and being properly proportioned in all their parts in accordance with their cylinder power, and having large steam passages, well regulated valves, steel piston rods, pins, etc., they are very much quicker than the old style hoisting engines, as well as being more economical in the use of steam. In designing these engines, special care has been taken to make those parts subject to sudden or unusual strains particularly strong. They also contain the latest improvements and devices now called for in a first-class hoisting engine. They are fitted with an improved friction drum, which is adapted for all kinds of hoisting duty, and especially adapted for pile-driving. The friction is composed of hard wood, bolted firmly to the spur-wheel, and turned off taper to suit the flange on the end of the drum, and is applied at the end of the drum shaft by means of a screw, pin and lever, shown in the cut. It is claimed for these frictions that they last for years, as the company have engines that have been running for several years on which the friction is in apparently as good condition as when new.

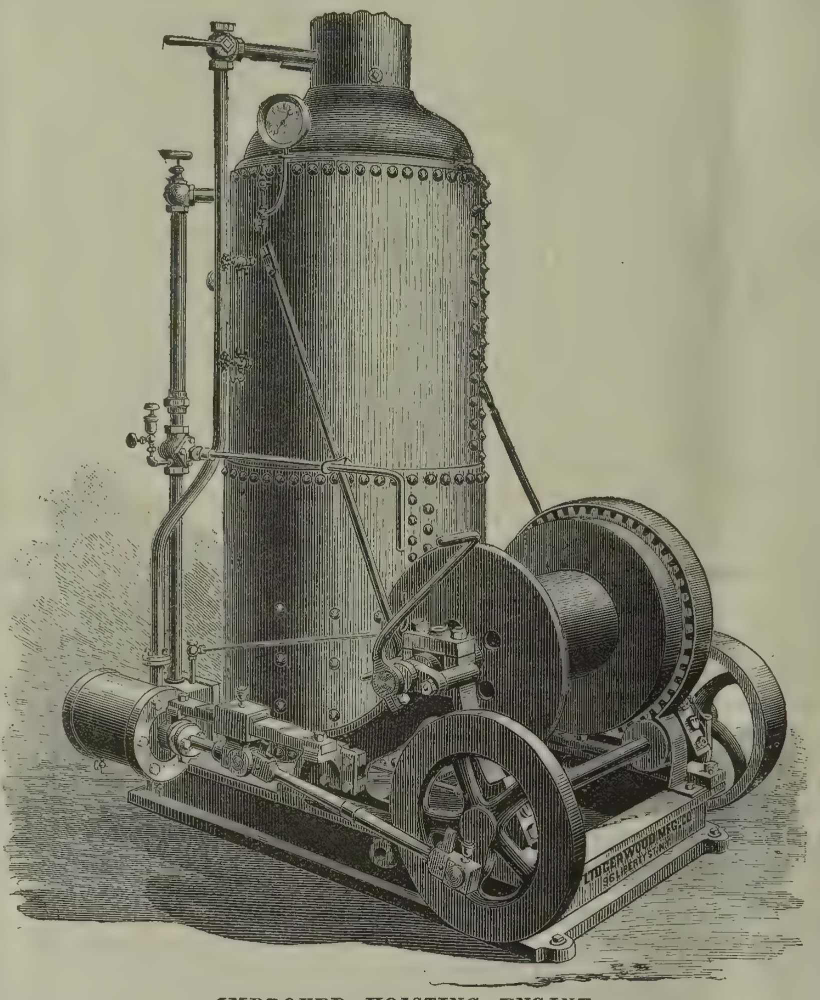
The boilers are of large capacity for each respective size cylinder, made of the best material and workmanship, and fitted complete with all cocks, valves, gauges, smoke-stack, grates, ash-pan, fire tools, exhaust cock, etc., the whole being a complete portable machine, mounted upon a heavy cast iron frame.

Care has also been taken in the general design of the machine to avoid accidents that frequently occur in the use of hoisting machinery, so that broken parts may be replaced without returning or replacing the same, or half of it—in other words, nothing is cast together which could be cast in pieces and bolted together; and all joints are faced, and all pieces that are placed upon the bed plate have reamed steady pins, so that the whole machine may be taken apart and put together again by any one of ordinary intelligence, and all the parts be right in line and in working order.

These machines are all built upon special tools for the purpose, consequently all parts are interchangeable for their respective sizes, and are made in quantities at a time, different proportions being used for each size cylinder. Every machine is set up and thoroughly tried with steam before leaving the works, thereby insuring a perfect working machine, and every engine is guaranteed. These engines are made with single or double cylinders and single or double hoisting drums, all complete on one frame or bed plate, and of any size or capacity desired.

The manufactory is located at Elizabeth, Dwight and Van Dyke streets, Brooklyn, N. Y., and the salesrooms and offices at 96 Liberty street, New York.

A Good Packing for Faced Joints is said to be common drawing-paper soaked in oil. After a time the heat of the steam converts it into a substance like parchment, so that it is indestructible. It possesses the advantage of stripping readily when it is desired to break a joint.



IMPROVED HOISTING ENGINE.

New England Manufacturers' and Mechanics' Institute.

The plan of the New England Manufacturers' and Mechanics' Institute, now in process of organization in Boston, and alluded to in our last issue, strikes us very favorably. Mechanical and industrial exhibitions, held under the auspices of mechanical associations and institutes, are given in various cities throughout the country at stated intervals, and invariably attract a large share of public interest, as witness the annual fall exhibitions held in New York, Cincinnati and Pittsburgh. These exhibitions, however, are temporary in character, being rarely kept open longer than six weeks or two months, and for the sake of catching the eye and dollars of the public, much that is trashy and trifling is admitted to them.

The idea of a permanent exhibition, in which shall be displayed for examination and comparison the latest and best products of mill, factory and workshop, is a most commendable project, and one that deserves to succeed. The plan of the New England Manufacturers' and Mechanics' Institute possesses the elements of practicability to a greater degree than any former scheme of the kind that we know of. The most notable effort in this direction was made in Philadelphia, where a Permanent Exhibition Company was organized shortly after the close of the Centennial Exhibition in 1876, and which succeeded in securing possession of the main building for its purposes. In spite, however, of the possession of the finest exhibition building in the country, and its location in one of the leading manufacturing centers, the permanent exhibition has languished, and the company is at the present writing on the eve of dissolution. For this failure several reasons are assigned. The distance of the building from the heart of the city, which was not noticed in view of the unequaled attractions of the Centennial, is doubtless one of the difficulties with which the Permanent Exhibition Company had to contend; but the chief reason of their failure, unquestionably is to be found in the fact that the plan and organization of the company did not originate with the leading machine builders and manufacturers of that city, the class that would be most benefitted by its success, but was put into shape by a few public-spirited gentlemen who took it for granted that the industrial class would be prompt to avail themselves of its advantages. These anticipations, unfortunately, were not realized. The leading manufacturers held aloof from the enterprise, or were lukewarm in its interest, and from the time of its inauguration until to-day, when it is on the eve of dissolution, the history of the Philadelphia Permanent Exhibition has been one long, wearisome struggle for existence. The Boston enterprise enters upon its existence with better assurances of permanent success. The fact named in our former references to it, that its stockholders comprise 1,000 of the most influential manufacturers of the six New England States is of itself the best assurance that the Institute commands the warm support of the class whose interests are closely involved in its success, and without whose coöperation it must fail. Ushered into existence under such favorable auspices, the New England Manufacturers' and Mechanics Institute bids fair to have a future of prosperity and usefulness, all of which we heartily wish may be its portion.

Fuller's "Common-Sense" Drying Apparatus.

We have lately had the opportunity of witnessing the operation of this apparatus at the large furniture manufactory of Herts Brothers, 163 West 18th street, in this city, and were so favorably impressed with its simplicity, and the obvious correctness of the principles on which the method is based, that we have made arrangements to publish an illustrated description of the apparatus in our July number.

Meantime we will merely mention, incidentally, that Mr. Fuller, realizing the unsatisfactory and defective features of the ordinary plans in vogue, employing hot air and ventilation, which are especially troublesome when applied to the artificial seasoning of lumber, has substantially modified and improved the same by providing a simple means of drying or dessicating the air before it enters the drying chamber. By this artifice, the air entering the drying chamber has its capacity for absorbing moisture greatly increased, the temperature required need only be very moderate (a feature that is of great importance in preventing the warping and checking of lumber), and the operation of drying or seasoning is materially hastened.

Briefly described, Mr. Fuller's plan embraces the following elements: He provides a close drying room for the material to be dried, heated by means of a steam pipe to a moderate temperature, regulated according to the nature of the material. The air conveyed to the dry-room, before entering, passes through a condenser kept at a low temperature by a stream of cold water. On its passage through this, its moisture condenses, and it enters the dry-room dessicated and in a condition to eagerly absorb it as it become heated, from the articles to be dried. An exhaust pipe leads from the upper part of the chamber to the fan, so that the same air is used over and over again. After having made the circuit of the dry-room, it is drawn out through

the exit pipe by the fan heated and laden with moisture; in its passage through the cold condenser it deposits its moisture, and enters again at the bottom of the chamber, ready, as rapidly as it is heated by the steam pipes, to do its work over again.

Mr. Fuller's apparatus is adapted for drying lumber, grain, chemicals, wool, cotton, and for other purposes too numerous to specify. At present we refer our readers for any points we may have omitted in this brief notice, to Mr. Fuller's card in our advertising columns.

New Compound Pumping Engine.

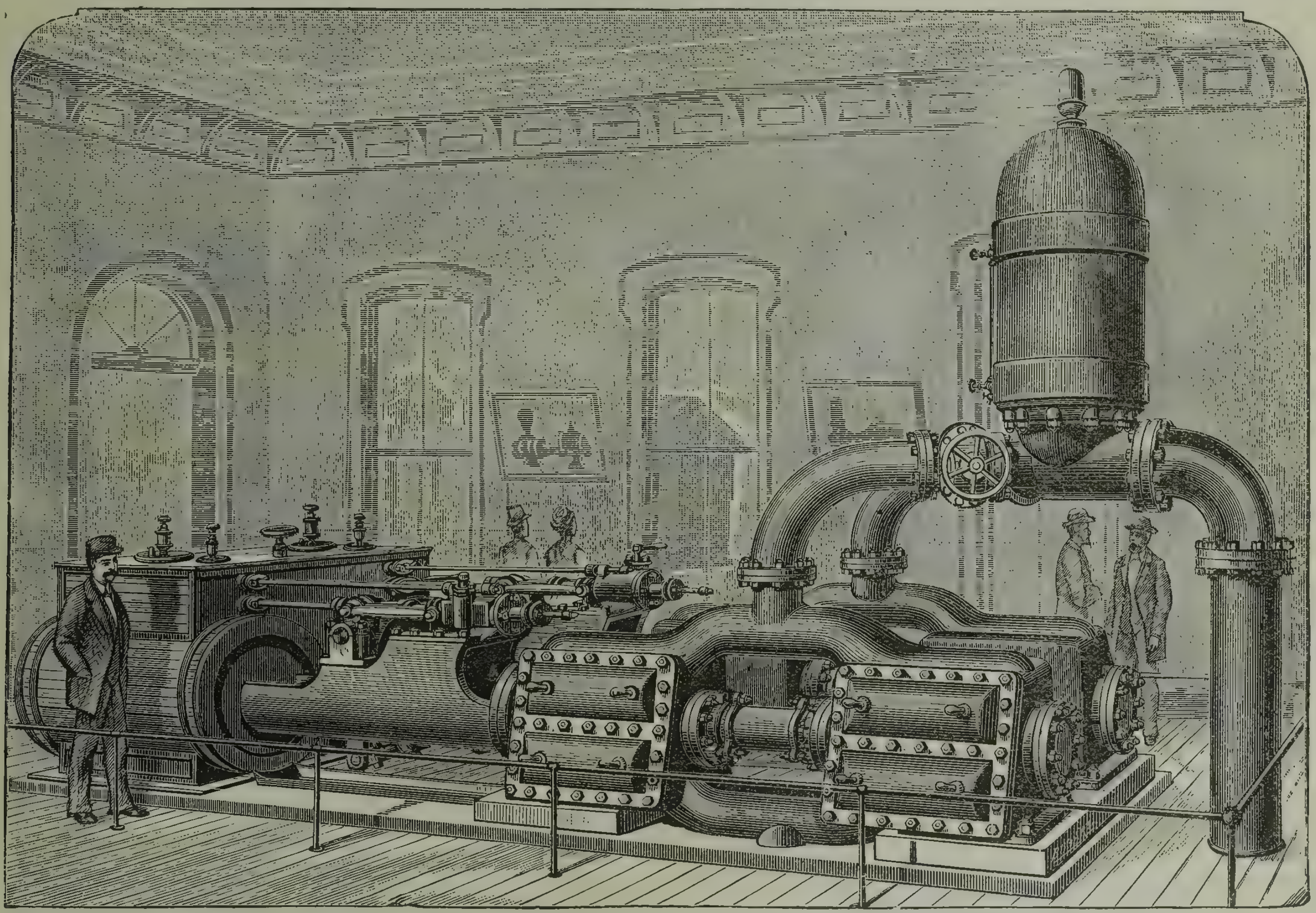
The attention of town and city authorities is especially desired to the consideration of the peculiarities and merits of the compound pumping engine described below, which embodies in its construction and operation certain new features which are affirmed to be vastly superior in duty to the old and no more expensive in operation and maintenance.

The compound pumping engine illustrated and described herewith is one of the best representatives of its class, and embodies certain specially advantageous features in its construction.

The most desirable plan for moving water is by the direct action of a steam piston upon the plunger of the pump; and the labors of the makers of pumping machinery have been expended in the task of effecting a combination of the pump with an engine that would yield the highest duty—in other words, with an engine that would work the steam in the most economical manner. In the compound engine herewith illustrated we have a machine eminently adapted to meet this requirement. In this we have the steam doing a portion of its work in one cylinder, operating one plunger of the pump, then exhausting into a large receiver beneath the floor, and expanding into a second cylinder, whose piston operates another pump plunger. To render the equalization of force between the two cylinders as nearly perfect as possible, a notable advantage is derived from placing the receiver between the cylinders, which, by the addition which it makes to the volume of steam affected by influx and efflux, materially assists in maintaining uniformity of pressure. The two steam pistons moving coincidently, the degree of expansion is governed by the relations of the areas of the two steam pistons and their stroke. The relation of these areas is determined by the steam pressure, the grade of expansion determined on, and by the measure of work to be done.

The engraving shown illustrates an engine of the type above described. They are in use at the water works of Milwaukee, Wis.; Cincinnati and East Liverpool, O.; and Trinidad, Colo., and have been constructed up to the capacity of eight million gallons for twenty-four hours.

As above described, these machines consist substantially of two direct-acting pumping engines. They deliver into one main, but there is no further connection between them, save by the steam and water pipes. They have entirely independent motions, and their pipes and valves are so designed and constructed that either one or the other may be operated independently. The low-pressure engine is made at least equal in power to the high-pressure engine. An isochronal device is attached to the low-pressure engine, which insures a perfect regulation of the speed. The motion of the two engines being entirely independent of each other, the grade of expansion is varied by an increase or decrease in the speed of the low-pressure piston, which practically effects a change in the comparative volumes of the cylinders. The engine being self-adjusting, the low-pressure piston adapts its motion to the work required of it, thus maintaining the needful pressure in the receiver from which it draws its steam supply. In practice the engines are carefully proportioned for the work required of them, so that no excessive variations in the number of strokes of the engines shall occur.



NEW COMPOUND PUMPING ENGINE.

highly advantageous. The requirements of towns and cities of moderate size, which have been studied with much care by the makers of pumping engines, have originated many of the recent improvements in this class of machinery, inasmuch as they demanded the production of an engine which should combine with high duty a very moderate first cost, and economy in operation and maintenance. The last named conditions are imperative, and must be estimated by the relation which they sustain to the desired capacity of the works. These requirements have called out the best efforts of our engine builders, and the fruits of their labors will compare very favorably with the best achievements in other branches of the mechanic arts.

The improvements that have been made in this department of mechanical engineering have long ago displaced the old type of direct-acting pumping engines, in which the steam was used at constant pressure the full length of the stroke, and then exhausted at that pressure into the atmosphere without doing any further duty; and in place of these have come the compound engines using steam expansively, experience having demonstrated that engines of this type are

From the foregoing description it will be perceived that we have in this machine a self-adjusting, variable expansion, direct-acting pumping engine, which possesses special advantages on the score of simplicity of arrangement and extended adaptability.

These engines are manufactured by the Cope & Maxwell Manufacturing Co., of Hamilton, Ohio.

The Finest Floors are said to be seen in Russia. For those of the highest grade tropical woods are exclusively employed. Fir and pine are never used, as in consequence of their sticky character they attract and retain dust and dirt, and thereby soon become blackened. Pitch pine, too, is liable to shrink, even after being well seasoned. The mosaic wood floors in Russia are of extraordinary beauty. One, in the Summer Palace is of small squares of ebony inlaid with mother of pearl. A considerable trade is done in Dantzic and Riga by exporting small blocks of oak for parquet floors. There is an active demand for these in France and Germany, but none in England.

The New Workshop of the Stevens Institute.

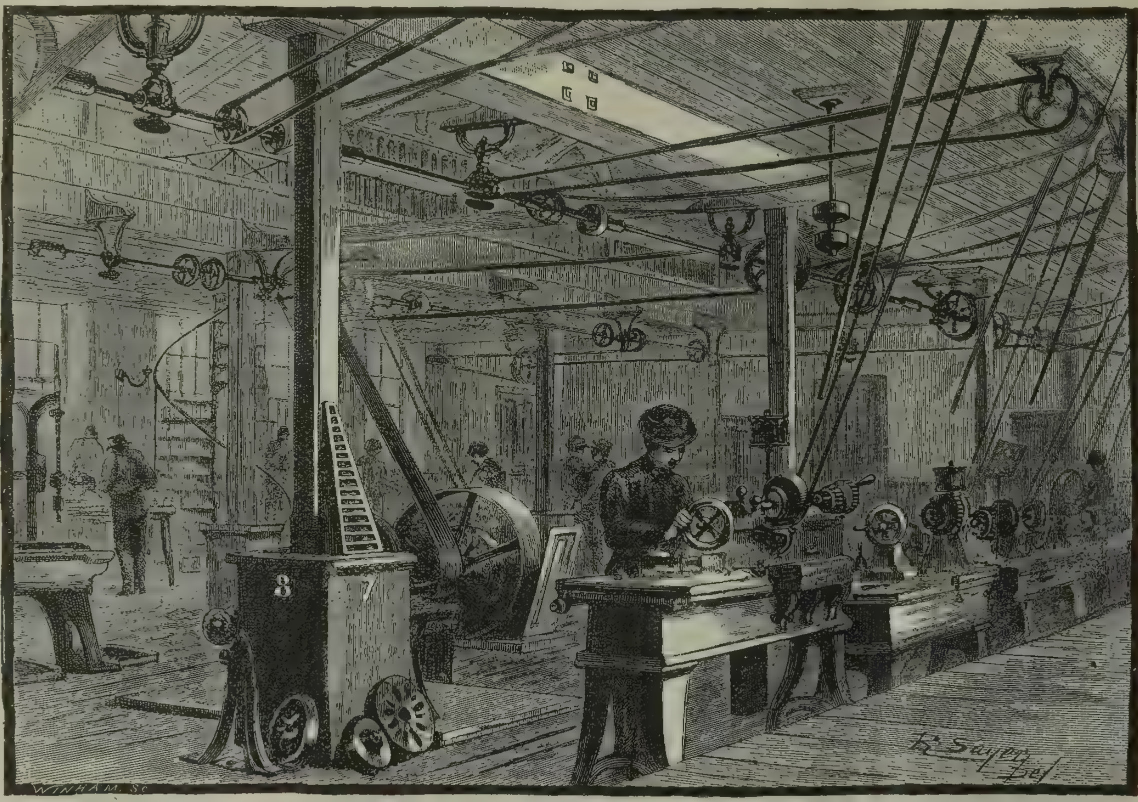
An interesting ceremony took place on the evening of May 14th, at the Stevens Institute of Technology, in Hoboken, the occasion therefor being the formal opening of an admirable workshop, which has been provided with a fine assortment of steam engines, lathes, planers, drills, milling machines, grinding wheels, and other mechanical appliances, at the cost of Prof. Morton, the President of the Institute, and by him generously presented to the trustees of this useful institution, for the benefit of its students.

The Stevens Institute has, in the brief period of about ten years in which it has been in existence, taken an advanced position among our technical schools; and this last addition to its facilities for combining practical with theoretical work and study, will add to the esteem in which it is held by the friends of technical education throughout the country The benefits of schools of the pattern of the Stevens Institute, where students are afforded the opportunity of practically familiarizing themselves with the work they will be called upon to take up in the world beyond the school, cannot well be overestimated. And the friends of this institution are to be congratulated that they have the services of an officer as its president, who so fully appreciates what it needs to enhance its usefulness, and who has generously shown himself able and willing to meet its wants by the gift of this model workshop. The new workshop occupies a fine apartment, 50 x 80 feet, with high open roof and double galleries, which was formerly the lecture-room of the institution.

As remarked at the outset, the ceremony of formally transferring the new addition to the trustees of the Institute, took place on the evening of May 14th, in the presence of a number of interested parties. The shop was brilliantly illuminated with electric lights and the machinery in full operation. Prof. Morton, in his presentation speech, gave a sketch of the institution, what it had already accomplished in the interests of technical education, and what it designed to do in the future. Mr. Dod replied in an appropriate address, accepting Prof. Morton's generous gift on behalf of the trustees of the Institute. Addresses were also made by Messrs. Coleman Sellers, Horatio Allen, and others.

Our engravings give an excellent representation of the interior of the new workshop and of the tool room.

Tool Room of the Stevens Institute.



INTERIOR OF THE NEW WORKSHOP OF THE STEVENS INSTITUTE.

American Society of Mechanical Engineers.

The second regular meeting of the American Society of Mechanical Engineers—whose organization we recorded last year—was opened on the evening of Wednesday, May 4th, in the Common Council Chamber, City Hall, Hartford, Conn., which had been placed at the society's disposal by the city authorities. The meeting was numerously attended, and the proceedings were of a most interesting character.

The society was formally welcomed by Mr. DeWitt C. Pond, President of the Common Council of the city of Hartford, in a brief but appropriate speech, which was responded to very happily by Prof. Thurston, the president of the society. The opening address of the president represented the society as being in a very flourishing condition. The roll of members now numbers over 250, including among them many of the most distinguished names in the profession. This indication of vitality and prosperity is most promising for the future of the society, and is especially worthy of notice, as less than a year has elapsed since its first organization.

The proceedings proper of the society are briefly condensed in the following: The first action was the passage of a resolution deprecating the legalization of the metrical system. It is noteworthy, first, here to notice that the metrical system meets with more stubborn opposition from the mechanical engineers than from all other sources. The Franklin Institute, one of the leading mechanical societies of the country, put itself squarely in opposition to the introduction of the metrical system some time ago. Though the action of the society does not meet with our approval, our object here is not to indulge in criticism, but to record the events of interest that happened. The text of the resolution against the metrical system, which was passed by the large majority of 111 ayes to 24 noes, was as follows: "*Resolved*, That the society deprecates any legislation tending to make obligatory the introduction of the metric system of measurement into our industrial establishments. Also, that the secretary be instructed to communicate the sentiments of this resolution to any one concerned in procuring such legislation. And, further, that a copy of this resolution be sent to the Anti-Metric Society, of Cleveland, Ohio."

The remainder of the evening was occupied by the reading of papers by Prof. Thurston on the "Ratio of Expansion at Maximum Efficiency," and by Albert R. Wolff and James E. Denton on "The Most Economical Point of Cut-Off in Steam Engines." These papers provoked a lively discussion, which was continued at the opening of the Thursday morning session. At this session the principal papers read were the following: By Chas. E. Emery, on "Alterations to the Cross-Head of a Corliss Engine," another by the same author on "Experiments with Non-Conducting Coverings for Steam Pipes," and another by A. F. Nagle on "Formulæ for Belt Power." These papers were all very freely discussed. At the afternoon session, the following papers were read: "Experiments on the Adhesion of Leather Belts," by Samuel Webber; "The Binary Absorption System of Ice Machinery," by H. F. J. Potter; "A Brief Treatise on the Steamboat Cam," by Lewis Johnson; and "The Continuous-Rod Mill of the Trenton Iron Co.," by William Hewitt.

Thursday evening was devoted to social enjoyment, one of the pleasant features of which was a banquet in which the members and a number of invited guests participated. In the course of the evening, the memory of the great hydraulic engineer, Henry R. Worthington, was duly honored by a number of speakers, who paid feeling tribute to his eminent professional services and personal worth.

The next day (Friday) was given up to visiting a number of Hartford's prominent industrial works. The society in a body visited the establishments of I. B. Davis & Co., the Pratt & Whitney Co., the Hartford Machine Screw Co., the Billings & Spencer Co., Colt's Patent Fire-Arms Manufacturing Co., and the Hartford Engineering Co. In the evening some further formal business was transacted, after which the society adjourned.

The career of this society in the brief period of its existence has been most prosperous, and must be highly gratifying to the original thirty who met together to found it about a year ago. It has a large and

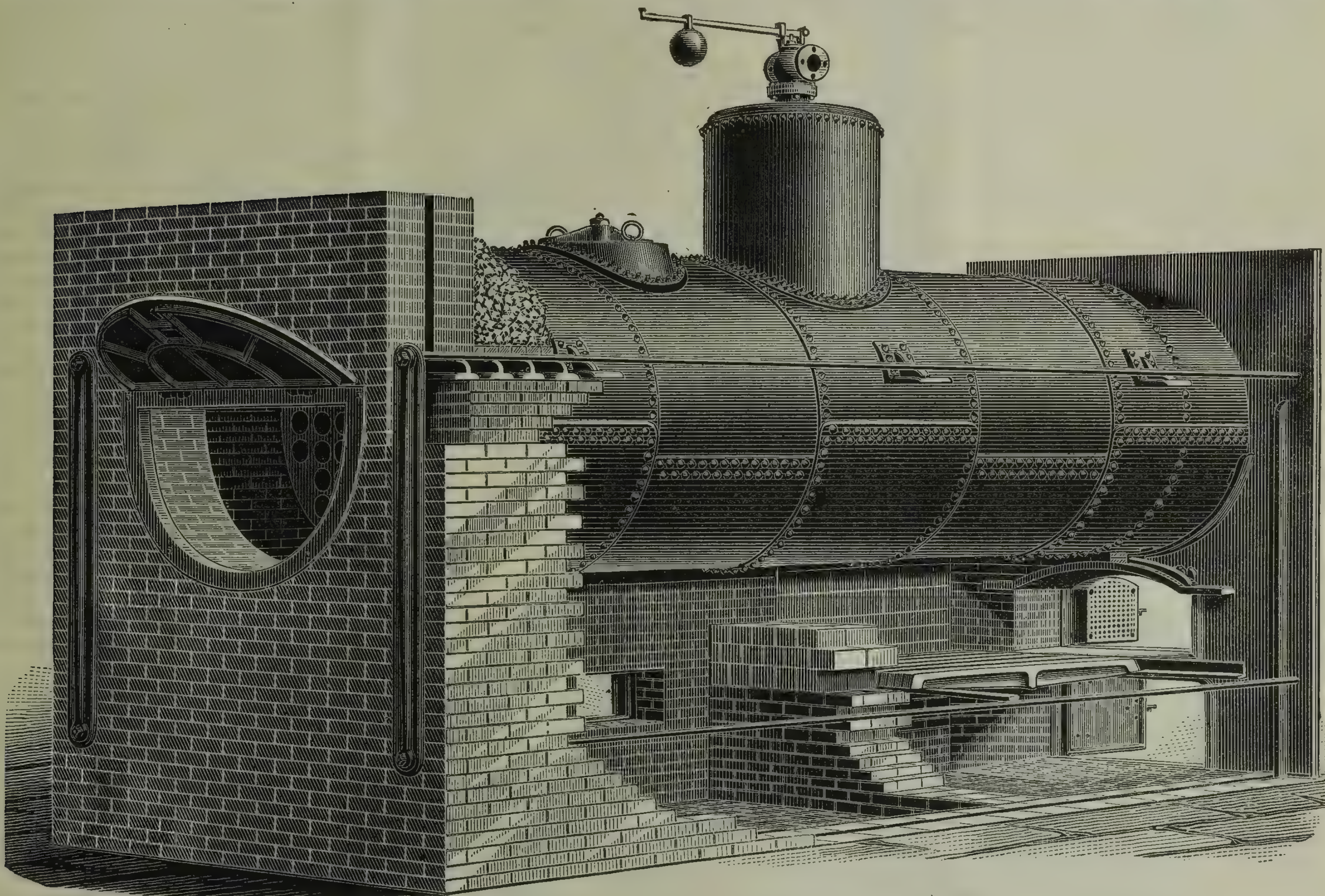
influential membership, which is growing very rapidly, and its financial condition is no less satisfactory. It is a matter of surprise that a national association of mechanical engineers was not long ago brought into existence, as the present decided success of the American Society proves at once that the necessity and the advantage to the members of the profession of such organizations are fully appreciated. We predict for this young and vigorous society a prosperous and useful future, and congratulate its members, and especially its founders, on the gratifying success with which their efforts have already been crowned.

The Bigelow Boiler.

The accompanying illustration represents a return tubular boiler, manufactured by H. B. Bigelow & Co., of New Haven, Conn.; and while not distinguished by any special novel features of construction, is an excellent representative of this very serviceable and popular type of boilers. A glance at the excellent engraving annexed, which shows the boiler in place, with a portion of the masonry removed to permit of better inspection, will give our mechanical readers a fair idea of this generator, and will render an elaborate description unnecessary.

In general terms, we may explain that in these generators the heated furnace gases pass beneath the boiler, the same as in a plain cylinder boiler, returning through the tubes into a smoke chamber, and thence to the stack. This type of boiler has long been held in the highest esteem, because of its excellent steaming capacity.

With sizes over 40 horse-power, the manufacturers call attention to the fact that they place a man-hole in the front head under the tubes, which has the advantage of enabling a man to pass along the whole length of the boiler and remove any sediment that accumulates on the bottom, as well as giving him the opportunity of examining the tubes and other points inside.



THE BIGELOW RETURN-TUBE BOILER.

With this boiler the makers furnish the front properly fitted, grate bars, binder bars, back and side doors, anchor bolts, safety valve, try-cocks, blow-off cocks, steam and glass water gauges. The boilers are made of the best material, and submitted before leaving the factory to a hydrostatic pressure of 150 pounds to the square inch. They are supplied to order of any desired power from 20 horse upward.

Further details will be furnished on application to the manufacturers, Messrs. H. B. Bigelow & Co., River street, New Haven, Conn.

Statistics of the Manufacture of Pig Iron.

A late number of the Bulletin of the Iron and Steel Association contains some highly important facts respecting the production of pig iron in the United States during the year 1880, which show most convincingly the growth of the country within the past two years in substantial prosperity. These statistics, which are issued officially by Mr. James M. Swank, the able secretary of the association, show that the production of pig iron in the United States in 1880, reached the hitherto unequaled figures of 4,295,414 tons (of 2,000 pounds). For the preceding year, which had previously taken the lead in production, the figures were 3,070,875 net tons. The increase in production in 1880, was, therefore, 1,224,539 net tons over that of the previous year, or nearly 40 per cent. The production of 1880 was nearly double that of any of the years immediately preceding 1879, and more than double that of the centennial year 1876, when the production of iron during the panic years had reached its lowest point. For the sake of exhibiting these facts to the eye, we give herewith a tabulation of the production of pig iron for each year, commencing with 1872:

PRODUCTION OF PIG IRON.

Year.	Net Tons.
1872	2,854,558
1873	2,868,278
1874	2,689,413
1875	2,666,581
1876	2,093,236
1877	2,314,585
1878	2,577,361
1879	3,070,875
1880	4,295,414

The total production of the year 1880 was divided as follows:

Fuel.	Net Tons.
Anthracite	1,807,651
Bituminous and coke	1,950,205
Charcoal	537,558

The following facts incident to this leading industry will have interest for most of our readers: Twenty-three States made pig iron in 1880, one more than in 1879, Minnesota entering the list for the first time with her Duluth charcoal furnace—the pioneer, we have no doubt, of many other iron enterprises within her borders. North Carolina has not made any pig iron since 1877. Oregon, with her Oswego charcoal furnace, doubled in 1880 her production of 1879. Another State, Colorado, has its first furnace, at South Pueblo, ready to be put in blast. California and Washington Territory are getting ready to make pig iron, a furnace in each being well under way. Utah Territory has made no pig iron since 1876, but the largest and best of its two furnaces (the one at Ogden) is likely to be blown in this year.

Every State in the Union which made pig iron in 1879, except one, increased its production in 1880. The exception was West Virginia, which made 70,801 net tons in 1879, and 70,338 tons in 1880. In 1879 Pennsylvania made $52\frac{1}{2}$ per cent of the total production; in 1880 her production declined relatively to $48\frac{1}{2}$ per cent. Ohio made a very sharp advance in 1880 upon her record of 1879. In 1879, with a product of 447,751 net tons, her percentage of the total product of the country was $14\frac{3}{5}$; in 1880, with a product of 674,207 net tons, her percentage was $15\frac{7}{10}$. The

States which ranked next to Pennsylvania and Ohio in production in 1880, and which produced over 100,000 tons each, were New York, New Jersey, Michigan, Illinois and Missouri, in the order named.

There was a gratifying increase in 1880 in the production of spiegeleisen, which is used in the production of Bessemer steel, and which is still largely imported by our Bessemer steel makers. The product was 19,603 net tons, against 13,931 tons in 1879; 10,674 tons in 1878; 8,845 tons in 1877; 6,616 tons in 1876; and 7,832 tons in 1875. The product of 1880 was made by the New Jersey Zinc Company and the Oxford Iron Company, in New Jersey, and by the Bethlehem Iron Company, the Cambria Iron Company, and the Edgar Thomson Steel Company, in Pennsylvania.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

Robert L. Stuart's mansion, on Fifth avenue three stories and Mansard, 54x112 feet, and extension 24 feet, will cost $350,000.

On Fifth avenue, 75 feet north of Sixty-sixth street, a four-story brown stone dwelling is to be erected at a cost of $40,000.

At No. 997 Fifth avenue, a four-story brick and Belleville stone house is to be erected for John Sloane. The cost is to be $90,000.

James Farmer is building a seven-story office structure at Nos. 42 and 44 New street. It is to be of brick, 50 feet and 44x50 feet.

Jas. L. White is erecting at Nos. 361 and 363 Broadway a six-story iron and brick store, 54 and 41x165 feet, at a cost of $250,000.

At No. 589 Fifth avenue, a four-story brown stone dwelling, 20x72 feet and 113 feet is being built. John Noble is the owner, and the cost is to be $45,000.

At Fifth avenue and Fifty-third street a four-story mansion, 50 feet 5 inches by 180 feet is to be erected of brown stone, and is to cost $100,000.

At No. 697 Fifth avenue a four-story brown stone dwelling is to be built for George S. Osgood. The dimensions are to be 25x60 feet, and the cost $60,000.

At Nos. 162 and 164 Broadway Henry Marquand is erecting a seven-story brick and sandstone office building, 59 feet and 54x141 feet, to cost $180,000.

The Sinclair House, at Eighth street and Broadway, is to be enlarged, the addition being more extensive than the present building. Orlando B. Potter is the owner.

The Union Ferry Company has decided to build ornamental ferry houses at a cost of about $80,000 in this city and Brooklyn, at the Wall and Fulton street ferries.

At No. 67 Wall street Henry Parish is erecting a seven-story office building, fire-proof, with a Westchester marble front, 37 feet and 36 feet by 79 feet, to cost $90,000.

A brick apartment-house, 74x91 feet and seven stories in hight, is to be built at the northwest corner of Madison avenue and Twenty-eighth street. It will cost about $12,000.

The Dominican Sisters are erecting a three-story brick convent in Sixty-third street, between First and Second avenues; it is to be 100x100 feet in superficial area, and to cost $75,000.

Plans have been submitted to the officers of the Bureau of Buildings for a six-story iron printing office and bindery for W. B. Smith at Nos. 57, 59 and 61 Park street. It is to cost $40,000.

H. O. Armour is to build a four-story brown stone mansion, on the southeast corner of Fifth avenue and Sixty-seventh street. The dimensions are to be 30x40 feet, and the cost $250,000.

On Fifth avenue, 60 feet south of Sixty-eighth street, a four-story brown-stone dwelling is to be erected. The dimensions are to be 40 feet and 23x17 feet (rear) by 100 feet and 67 feet. The cost is to be $65,000.

On the northwest corner of Madison avenue and Twenty-eighth street, a seven-story brick flat, 74 feet 1 inch and 50x91 feet, is being erected for the Hubert House Company. The cost will be $180,000.

On the southeast corner of Hudson and Leonard streets Robert Ogden Goelet has begun a nine-story brick building, with brown stone front, 100x40 feet on Leonard street and 116 feet on Hudson street, to cost $100,000.

Jacob Rupert is to build a house at Fifth avenue and Ninety-third street. It is to be of brick and Belleville stone, three stories and Mansard. The dimensions are to be 50x63 feet, with extension 30 feet, and the cost $90,000.

An engine house for Company No. 27 is to be built at No. 173 Franklin street, 25x87½ feet, and three stories high. It will cost $14,000. Company No. 21 is to have a new house at No. 216 East Fortieth street, costing $12,000.

On the southeast corner of Broadway and Nineteenth street, Wm. D. Sloane is building a six-story brick store, with stone piers, 128 feet 7 inches on Broadway, 187 feet on Nineteenth street and 47 feet 7 inches on Eighteenth street. The cost is to be $400,000.

The Vanderbilt office building at the southeast corner of Beekman and Nassau streets is being remodeled and raised to eight stories at a cost of $98,000. The entrances on both Beekman and Nassau streets are to be enlarged and the building is otherwise to be made more imposing.

J. B. and J. M. Cornell, W. J. Hutchinson and others have bought four lots on the northeast corner of Madison avenue and Sixtieth street, and, the subscription having already reached $110,000, a large and substantial house of worship is to be erected for the Methodist Episcopal Church.

On the southeast corner of Wall and Front streets an old building has been razed to make place for a four-story brick and blue-stone structure, 60x60 feet, for Nathan P. Rogers. The walls are to be of sufficient strength to support three additional stories whenever business demands them.

John Taylor Johnston is erecting an office building at 89 and 91 Wall street, the cost of which will be $125,000. It is to be fire-proof, of granite and white marble, and is to extend through to Beaver street, with a frontage of 36 feet 6 inches on Wall street and 54 feet 10 inches on Beaver street. Its average depth is to be 96 feet.

William Kuhles has drawn plans for a building to be put up in First street, extending through to Houston street. It will be five stories high, with brick fronts. It will have a frontage of 25 feet 3 inches on Houston street and 25 feet on First. The average depth is to be 73 feet. There will be stores on Houston street, with dwellings above. Judge John A. Dinkel is the owner. The estimated cost is $17,000.

D. O. Mills is erecting an office building on the lots numbered 35 Wall, 11, 13, 15, 17, 19 and 21 Broad, and 35 Exchange place. It will have a frontage of 28 feet 11 inches on Wall street, 163 feet 6 inches on Broad street and 100 feet 9 inches on Exchange place. Above the basement of granite it will be of brick and Belleville stone, ten stories high, and fire-proof throughout. It is to be completed within a year and to cost $1,000,000.

Excavations have been begun for a new chapel and library for Columbia College. The library is to have a frontage of 120 feet on Forty-ninth street and to be 100 feet deep. The ceiling will be 60 feet above the floor. There is to be a fire-proof apartment, 54x63 feet and 40 feet high, in which valuable books are to be kept. The chapel back of this edifice is to extend through to Fiftieth street. The structures are to be of brick and to cost $750,000.

The New York Central and Hudson River Railroad Co. are about to erect buildings on the ground formerly occupied by the Manhattan Market, on the block bounded by West Thirty-fourth and West Thirty-fifth streets and Eleventh and Twelfth avenues. They are to be built of brick and granite trimmed with blue-stone, two stories in hight, heavily and substantially built, and the foundations will be on spiles. They will be built in two rows with an arched center, in which there will be two tracks erected, so that the railroad company may deliver merchandise directly at the doors of their tenants. The cost will be about $150,000. The plans were drawn by Joseph Richardson.

Workmen have begun to excavate for the ten-story addition to the *Tribune* building, or rather for the completion of that structure. The architect says that if he could have built at first according to the original plan, as he is now enabled to do, the critics would not have been tempted to use the adjective "grotesque" in speaking of his creation. He will add 46 feet to the Spruce street frontage and carry the building through to Frankfort street, 169 feet. The Frankfort street front will be 28 feet 9 inches, and of cast iron, set between the Wall heads of the longitudinal walls. The structure is to be fire-proof, to cost $228,000, and to be completed by April 1, 1882.

New buildings are to be erected for the Union Theological Seminary of this city. The site which has been selected comprises ten city lots, between Sixty-ninth and Seventieth streets, fronting on Fourth avenue, and nearly opposite the Normal College for Women. A Building Committee has been appointed, and work will begin immediately. It is understood that three connected buildings will be erected, at a cost not exceeding $250,000. One, a fire-proof structure, will contain the Morgan library; another the chapel and lecture rooms; the third, the students' dormitories. The faculty hope that the seminary will be installed in its new quarters by September, 1882.

Miscellaneous.

The Cuvier Club at Cincinnati are building a new house to cost about $30,000.

George Edbrook, architect, is finishing designs for Battery D's new armory at Chicago.

A school-house, to cost $40,000, is about to be built at Nos. 145 and 163 Evergreen street, Chicago.

The Emery Brothers will build a seven-story hotel in Cincinnati at the corner of Sixth and Vine streets.

George L. Dunlap, is to build a grain-elevator, 103x308 feet, on Thirty-third street, Chicago, to cost $400,000.

J. S. Farren & Co. are building an extensive factory on Boston street, Baltimore. It is to be 40x100 feet, three stories high.

Graffin & Co. are building extensive chemical works on their property at Canton, near Baltimore. The building and machinery will cost about $150,000.

A building is to be erected at Raleigh, N. C., for the Department of Agriculture. The authorities have adopted the plans of E. G. Lind, a Baltimore architect.

There is being erected at Denver, Col., an office building, three stories and basement, 50 feet frontage, for the *Daily Denver Times;* R. W. Woodbury, proprietor; R. S. Roeschlaub, architect; cost $28,000.

It is now definitely settled that Tony Pastor will erect a new theater in Brooklyn. It will be built on Fulton avenue, one block above the old Olympic Theatre, and will have a seating capacity for 3,000 people. It is to be constructed under the personal supervision of Tony Pastor himself.

Parfitt Brothers have drawn plans for a building in Brooklyn, to be known as the Industrial Association Home, and to be located on Concord street opposite Prince street. It will have a frontage of 25 feet, 32 feet rear, and a depth of 45 feet. It is to be two stories high, with attic and cellar, of brick and stone and terra cotta trimmings. Cost about $6,000.

Charles I. Berg has drawn plans for several new buildings to be added to the Jewish Foster Home and Orphan Asylum at Germantown, Pa. The main building will hold sixty children, and is 45x45 feet, one story high, and of Germantown stone. The out building is 50x95 feet, three stories high, of Philadelphia pressed brick. The whole cost is $10,000.

Large No. 5 Band Re-Sawing Machine.

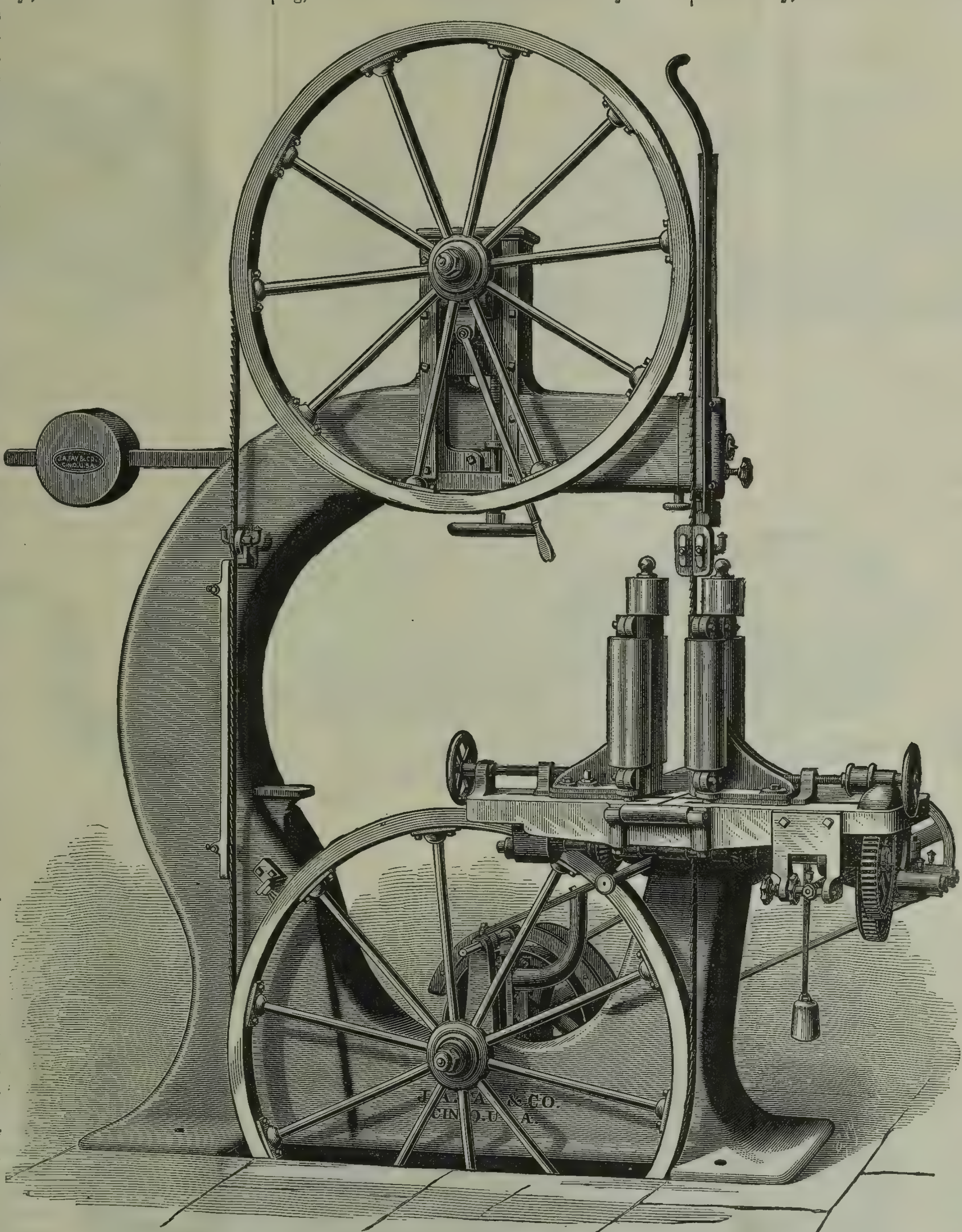
The band re-sawing machine herewith illustrated is of recent design, and its constructors—Messrs. J. A. Fay & Co., of Cincinnati, Ohio—have aimed at strength, durability and capacity, and have succeeded in attaining a high degree of perfection—greater than usual in this class of machinery; and the machine is so marked a departure in this line of wood-working machinery, that we are glad to place it before our readers for their study.

It is adapted to reducing deals to lumber, or re-sawing boards to thinner stuff, for panels, picture backing, etc., and for splitting veneered panels. It will saw lumber 24 inches in width, and to the center of 8 inches, or down to the very thinnest material that admits of re-splitting. As the saw used on this machine produces a kerf of less than one-16th of an inch, the saving in lumber is remarkable. For economy in this respect, it is claimed to surpass any re-sawing machine yet designed, and bids fair to supplant and drive from the market entirely the old vertical up-and-down circular machines, because of the immense saving effected.

The framing of the machine is massive, and is made in cored sections, thus combining stiffness and strength. A large base gives the machine good floor support, admitting of its being driven at a high rate of speed without vibration.

The wheels are 48 inches in diameter, and arranged with an elastic surface for the saw to run on. The upper wheel has a vertical adjustment to admit of the use of saws of different lengths, and it is so arranged that the saw may be run on any part of the face of the wheel, and has a superior weighting device for retaining the saw at its proper tension. The saw runs in patent anti-friction guides, which are provided with a steel roller at the back to receive the thrust of the saw, and laterally adjusting side guides to take up the wear and suit saws of different widths. The upper guide, with its supporting bar, is counter-balanced for its vertical movement. The feed works are provided with four heavy feeding rollers, all driven, both sides being adjustable; one pair is made yielding, to allow for inequalities in the lumber being sawed, and to give the necessary pressure. The speed of the feed is graduated by friction, and will remain in any position, or it can be moved to feed lumber at different speeds, varying from 5 to 40 feet per minute, without stopping the machine. The table can be set to different angles for bevel sawing, and the rolls are so mounted that they can be almost instantly changed to a clear plain table for common band or scroll cutting. The working parts of the machine for making the various adjustments, regulating the speed of the feed and the position of the feed-ing rolls, starting and stopping the machine, etc., are convenient to, and under perfect control of, the operator.

Any other particulars may be had by addressing the manufacturers.



LARGE BAND RE-SAWING MACHINE.

Cement for Leaky Steam Joints.—Take ten parts of white lead ground in oil, three parts of black oxide of manganese, and one part of litharge. Reduce to a proper consistency, and apply where needed.

America's Coal Supply.

At a late meeting of the American Association, an interesting paper on America's coal supply was presented by P. W. Sheafer, of Pottsville. "The coal resources of Great Britain," Mr. Sheafer says, "are all developed now and in process of depletion; while in this country, when our 470 miles of anthracite are exhausted, we have more than four hundred times that area, or 200,000 square miles of bituminous, from which to supply ourselves and the rest of mankind with fuel. The coal product of the world is about 300,000,000 tons annually. The North American continent could supply it all for 200 years. With an annual production of 50,000,000 tons, it would require twelve centuries to exhaust the supply. But with a uniform product of 100,000,000 tons per annum, the end of the bituminous supply would be reached in 800 years. What the annual consumption will be when this continent supports a teeming population of 400,000,000 souls, as will be the case some day, must be left to conjecture. But with half that population, as energetic, restless and inventive as our people in this stimulating climate have always been, it is a very moderate estimate, guided by the actual output already reached in Great Britain, to suppose that there will be ample use for 100,000,000 tons a year of bituminous coal for home consumption alone. We have about 340 collieries, and produce 20,000,000 tons per annum, or about 60,000 tons each. Great Britain has nearly 4,000 collieries, and mines 132,000,000 tons, or 33,000 tons per colliery. Most of the anthracite mining in the United States is now done at a less depth than 500 feet vertical."

Packing Rings.—A ring larger than the cylinder will never fit the cylinder when cut to pieces. "The safe side of a piston fit is the small side." Even those rings which are intended to spring out of their own accord and fill the cylinder, should be turned to fit, and after they are cut they may be opened out by expanding them on a lathe chuck.

Explosion of Two New Horizontal Tubular Boilers.

The following case of explosion, in which we present the views of the officers of the Hartford Steam Boiler Inspection and Insurance Company, attracted much attention at the time of its occurrence. The explosion took place at Newburyport, Mass., on the 27th of December, 1880, and is generally referred to as the "Newburyport Explosion," the circumstances making it a notable case. The following is the *resumé* of the case presented by the Hartford company's bulletin:

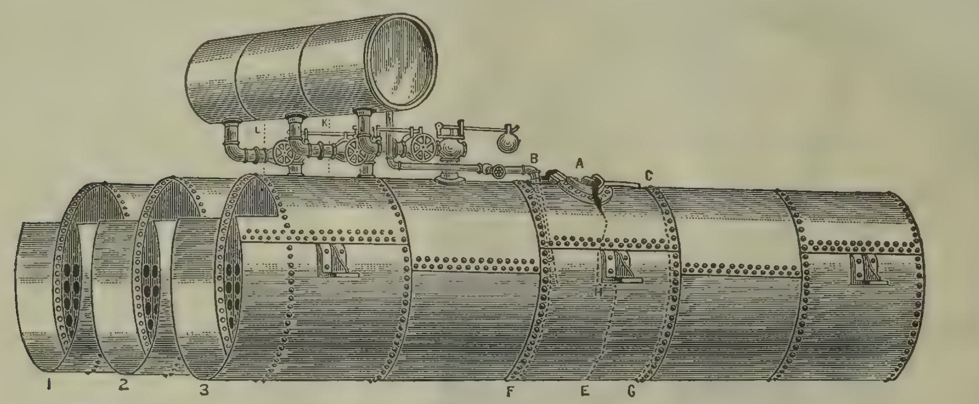


FIG. 1.—Showing relative position of the boilers Nos. 2 and 3, the two that exploded breaking first at the man-hole of No. 3. B F, A E, and C G, secondary lines of rupture; K L, dotted lines showing location of brick piers built for the support of the steam drum, upon the mid-walls of the setting.

Recent information received through the regular channels of this company embraces a statement of all the facts that now appear to be entitled to a place in the foundation of the conclusion embodied in this report. The following extracts from two reports of inspector Fairbairns contain the gist of the matter. The cuts, except Fig. 1, are carefully drawn copies of photographs that accompanied the report. Fig. 1 is intended to represent the proportions, relative position, and some of the main attachments of the battery boilers, two of which, Nos. 2 and 3, were employed to supply steam to the engine, and No. 1 for warming the buildings. No. 1, the heating boiler, was shut off by a stop-valve (*not* between the boiler and safety valve) in the steam connection to the drum, and run at a low pressure, delivering steam through a nozzle located elsewhere on the shell (not shown in the cut or mentioned in the report). Near the close of the noon hour on the day above mentioned, but before many of the workmen had returned from dinner, boiler No. 3 exploded, and in opening struck No. 2, its nearest neighbor, which also broke in pieces, and they flew away almost simultaneously.

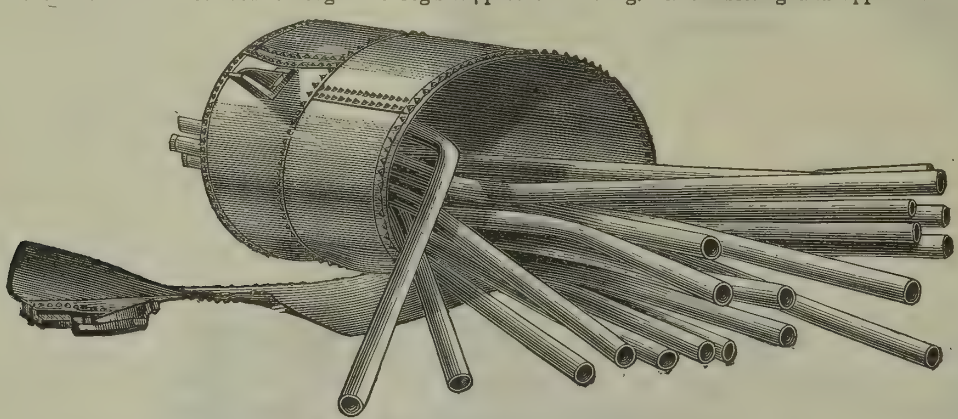


FIG. 2.—Part of No. 3 boiler, thrown 400 feet from the boiler-house.

The following is from the inspector's report dated December 29, 1880: "The boilers were 17 feet long, 54 inches diameter, with shells $^5/_{16}$-inch C No. 1 iron, stamped 45,000 pounds, with marks 'Paxton Rolling Mill, Harrisburg, Pa.,' and on other sheets 'Pottstown, Pa.' The heads were made from flange iron $^7/_{16}$ of an inch thick, with 50 tubes $3\frac{1}{2}$ inches by 16 feet long. All longitudinal seams double riveted. The boilers were well stayed, and considered safe at the required working pressure, with the proper appliances. They were set up at the factory in Newburyport, and inspected on the 13th day of October, 1880, for the purpose of insuring. Their setting and appliances were found in excellent condition and under careful management." The only defects found at this inspection were some slight leaks at a few of the tubes and at the laps, which were to be repaired at once; and the repairs were made and the boilers insured October 20, 1880. Up to the 24th of December matters remained the same. On that day the proprietors commenced to make alterations by connecting to the safety valve nozzle, a steam drum. The drum, which was not there when the boilers were accepted for insurance, is shown, with attachments, in perspective Fig. 1.

"Alterations were completed on Monday morning, and the boilers fired up and worked until the explosion took place." Referring to 1880 calendar, it will be seen that the 27th day of December fell on Monday; the boilers therefore exploded within six or seven hours after alterations were completed, and (comparing dates) *within the third month of their working age.*

In a later report, dated February 15, 1881, the inspector says: "The iron in their composition was of good quality; the workmanship was also good. Fragments show no signs of heating from lack of water.

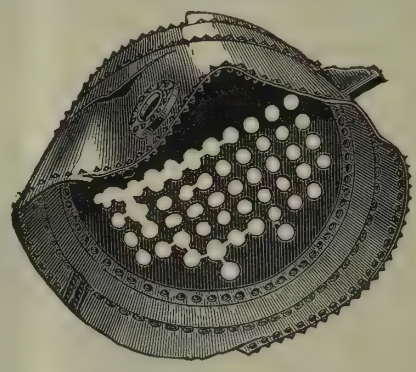


FIG. 4.—Front end of No. 3 boiler.

Between the 24th and 27th of December alterations were made in the way of connecting the steam drum to the safety valve nozzle, as already described. In so doing, the man-hole plates were taken out; when the work was completed the plates were returned to their places." It is reported that one of the workmen assisting in making the repairs, said, in speaking of the replacing of the man-hole plates, "the ordinary wrench was found too short to bring the plate to its place, so

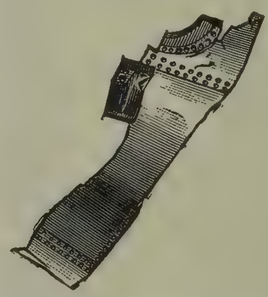


FIG. 5.—Part of middle course of boiler No. 3.

we took a piece of pipe $3\frac{1}{2}$ or 4 feet long and put over the end of the wrench," thus increasing the leverage, which, with the united efforts of two men, might become a dangerous and destructive agent, fracturing the man-hole frame. Without deciding as to whether this was or was not the cause of the disaster, it is proper to warn people who use boilers, against such practices. If the man-hole plate does not fit tightly, it is conclusive evidence that there is a defect in it, or in the frame, or that some foreign substance has found its way between the two; under these conditions, or if the castings were warped, it will be seen that such a pressure as might be applied by the contrivance above described, would produce fracture and locate a weakness that would ultimately result in disaster. The arrangement of the drum is a matter that has caused considerable comment. It was attached to pipes some four or five feet long, extending out from the safety valve nozzle. The drum was supported by piers built up from the walls of the setting. It will be seen by this arrangement that if the piers were too high or too low, a strain would be brought to bear on the walls of the safety valve chambers that would prevent the easy working of the valves. If this were the case, the steam might arise during the

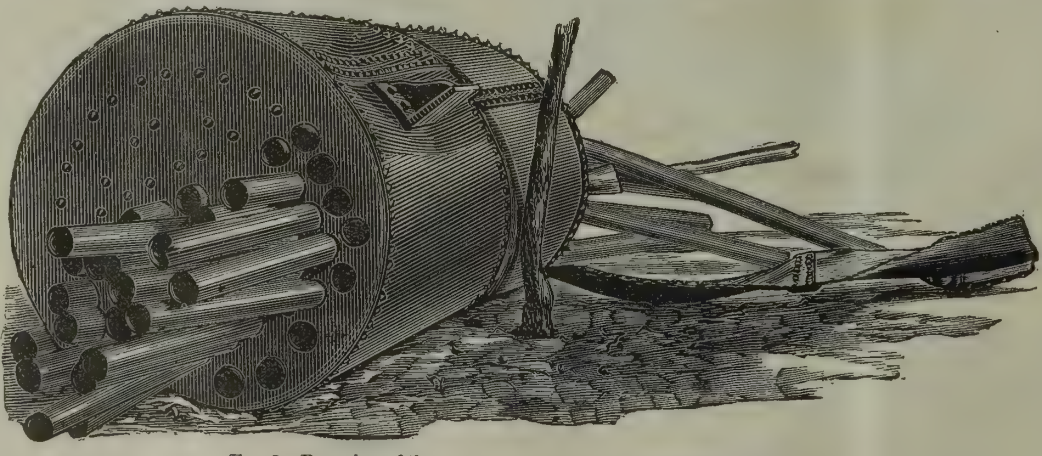


FIG. 3.—Rear view of the part of No. 3 boiler which is shown in Fig. 2.

noon hour to a dangerous point. We have rarely seen the steam drums of boilers connected in this manner. In one instance where such was the case, the parties in charge informed us that when the boiler was heated up and in use, the drum was lifted off from the piers, and it became necessary to wedge it up. With a drum weighing two or three tons more or less, a heavy strain would be brought to bear upon the safety valve nozzle under such circumstances. That the safety valves were found in good working order after the explosion, is no argument against the above theory, for they were then under entirely different conditions—the strains were removed and their condition was normal, unless broken and damaged by the explosion, which seems not to have been the case. While we do not favor this plan of setting up drums, we cannot say that it was the cause of the accident; but that some condition of things, brought about by the changes in the boilers, was the cause of the accident, is probably true, though it may be impossible to say just what it was. In this connection, we will say that we always advise a safety valve nozzle entirely independent of other steam connections. But our advice is not always followed. It costs but little to put on an extra nozzle; but when done the safety valve is free and independent of any other complications. It will be seen on examining Fig. 1, that there was a drip-pipe attached to the bottom of the drum which extended back near to the man-hole of No. 3 boiler, which it entered through a 1½-inch hole tapped through at the summit of the cylinder between the man-hole and the next forward girth-seam B, Fig. 1. Being thus on the weakest line of the shell, it is presumed that the initial rupture passed through this hole, as shown at B, Fig. 6.

The parts of No. 3 boiler are shown in Figs. 2, 3, 4, 5 and 6, Figs. 2 and 3 being different views of the same piece—namely, the rear head, the tubes, and two courses of plates; and Fig. 4 is the front end, showing the head from which the tubes are drawn; likewise two courses of plates, on the second of which is seen the flange of the main steam connection; while Figs. 5 and 6 show a portion of the middle course of plates which carried the man-hole frame and the drip pipe; this course, other parts of which are not drawn, completes the fifth course of No. 3 boiler, which it is thought first exploded. The lines of secondary rupture are shown by the dotted lines B F, A E, and C G, Fig. 1. Figs. 7 and 8 are parts of No. 2 boiler, which seems to have broken on transverse lines from a blow struck by the spreading middle course of plates of No. 3, which must have been of such a character and direction as to have instantly caused an extensive transverse fracture, for it has in this direction double the strength per unit of measurement that longitudinal lines have, besides the support afforded by the tubes extending from head to head. Fig. 7 is most likely the middle course of No. 2 boiler that received the blow from the middle course of No. 3, armed with the broken man-hole castings.

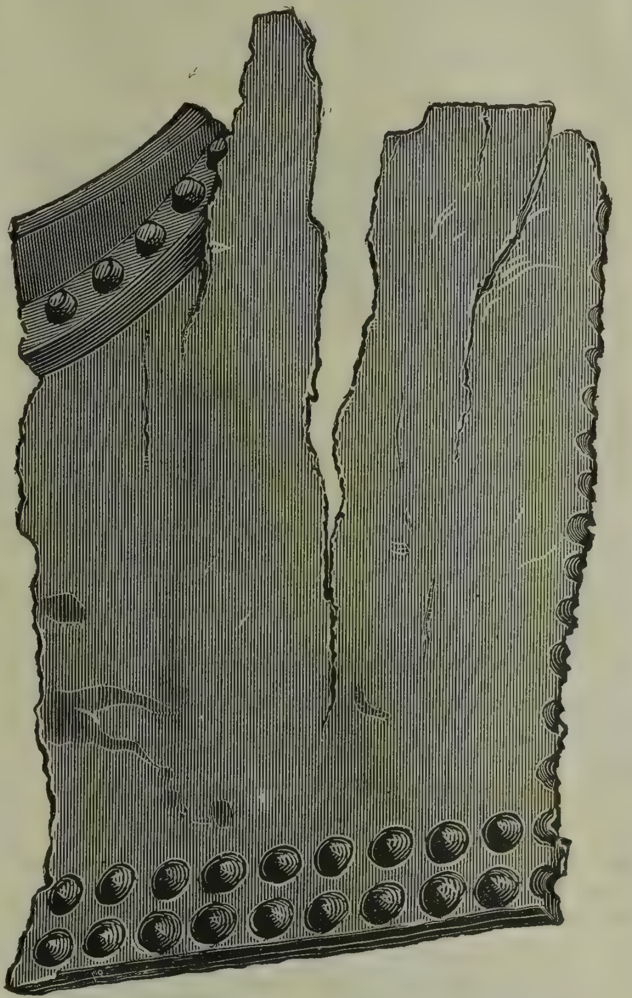


FIG. 6.—Part of the middle course of plates, boiler No. 3, showing broken man-hole frame which struck and fractured No. 2, splitting itself. Also showing at BB parts of the tapped hole through which the dregs pipe entered the boiler, as shown at B, Fig. 1.

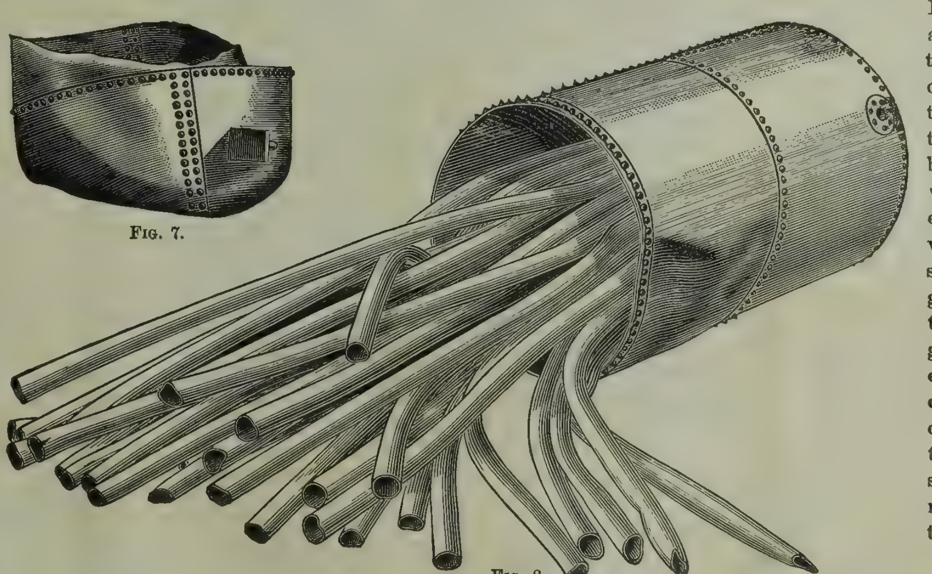


FIG. 7.

FIG. 8.

Figs. 7 and 8 are parts of boiler No. 2.

It has been stated that these boilers were inspected and insured by the Hartford Steam Boiler Inspection and Insurance Company shortly after they were built. Such was the case, and at the time they were regarded as safe for the work required of them. The addition of the drum was made without the company's knowledge, and the boilers were put to work at once without the "improvements" having been examined by the company's inspector. They exploded a few hours afterwards, and until then the insurance company was not aware that any changes had been made. What defects in workmanship or material would have been discovered by an inspection can therefore only be premised. But that important changes were made without the company's knowledge is true.

Explosive Energy of Water Gas.

An interesting scientific point, which we do not remember ever to have noticed in the voluminous printed discussions of the merits and demerits of water gas, has been brought out by Dr. Henry Wurtz, a well-known authority in gas chemistry, *apropos* of a recent explosion of Lowe gas which occurred at the works of the Westchester Gas Light Company, in Yonkers, N. Y. We are here not specially interested in the cause of this accident, which was due to carelessness in leaving a drip cock open under the floor of the purifying room, and would therefore have occurred with illuminating gas of any kind. The account of the accident states that a large volume of gas had escaped, and the most striking feature connected with the explosion was that it was so feeble, when the quantity of the gas is taken into account.

This point is one of special interest, and Dr. Wurtz, in an elaborate argument on the subject, shows very conclusively that the practical experience thus obtained as to the character (*i. e.*, the comparative feebleness) of the explosions of water gas was borne out by, and could be predicted from, theoretical considerations.

Dr. Wurtz's argument, concisely stated, is as follows: While ordinary illuminating gas contains large quantities (40 to 50 per cent) of marsh gas, water gas is rich in carbonic oxide. The quantities of air required in burning or exploding—and therefore the volume of products of combustion and the expansive energy developed—compare in these two gases as 1 to 4. The rate of propagation of the flame is much less, and the rate of diffusion—dependent as it is upon the specific gravity—is less also. Dr. Wurtz comes to the conclusion that gas explosions occurring with the new fuel gas will be far less destructive to life and property, on an average, than explosions of the gases heretofore in general use.

This conclusion, which is justified on both practical and theoretical grounds, is of the utmost interest to the friends and consumers of water gas, since it establishes the fact that in respect to the comparative danger from explosion, the new gas has distinctly the advantage of the old.

We mention this point because, although scientific men have all along been aware of it, this is the first time to our knowledge that it has been specially brought to public notice. Some time since, the editor of this journal was consulted for an opinion as to the choice between common coal gas and water gas for actuating an Otto gas engine, and gave answer, founded on the same reasons that Dr. Wurtz has advanced in the above, that in view of the relatively small quantity of air required for the complete combustion of water gas, and the relatively small volume of the combustion products, as compared with coal gas, the expansive energy developed from water gas, volume for volume, would be considerably less than that from coal gas, and that the latter should therefore be used in the engine. This answer, though covering the same ground as that of Dr. Wurtz, bears upon a quite different question. The connection of the two, however, will be so apparent to our readers, that no apology is necessary for introducing them together.

WEAR IN WIRE ROPES.—Dr. Chance, in discussing this subject at a late meeting of the Engineers' Club of Philadelphia, drew the conclusion that the cause of rapid wear is often due to the use of drums, sheaves and pulleys of insufficient size, and that a great saving might be effected by increasing their diameters, especially that of the small deflection and knuckle pulleys and sheaves. The actual wear averages 0.138 cents in slopes and 0.053 cents in shafts per ton for each 100 feet of lift.

The Polarization of Sound.

An article announcing the discovery of polarization of sound by Prof. S. W. Robinson, of the Ohio State University, has recently appeared in the *Journal of the Franklin Institute*, which we esteem to be of sufficient importance to give a brief statement of the leading points of the investigation. Before doing so, however, it may be better for the general reader to indicate the leading points in the theory of the polarization of light, upon which theory the fact of polarization of sound has an important bearing.

Rays of light are believed to be transmitted over a subtle fluid called ether, by waves, or undulations. When a wave passes any particular particle of ether, that particle is supposed to have a to-and-fro motion as the part it performs in the transmission of the wave. Several waves in succession cause as many movements, the same constituting a vibratory movement of the particle. The line of direction of this vibratory movement is stated, in most works on physics, to be at right angles to the direction of propagation, or of the rays; such vibrations are called transversal, and the possibility of the polarization of light has heretofore been regarded as dependent entirely upon this supposed fact of transversal vibration. But there seems to be no necessity for supposing that in front of a polarizer the vibrations shall be transversal, though it may be admitted that after passing the polarizer they are in some degree transversal.

In the transmission of sound waves, and in other cases, such as vibrating air columns, rods, etc., vibrations of particles of the medium are known to be longitudinal. Hence, if sound waves can be polarized where the vibrations in front of the polarizer are known to be longitudinal, it is fair and reasonable to suppose that the vibrations in light are longitudinal instead of transversal. Indeed, as regards the vibratory movement of a particle of matter situated at a distance from any center of disturbance considered as the cause of the vibration, it is difficult to conceive of the existence within any homogeneous medium of any means by which lateral impulses may be transmitted causing it to vibrate transversely. The action must be in the direct radial line of transmission. In support of this, we have the famous principle of Helmholtz regarding the action of natural forces among mutually interacting material points—namely, that the forces must be central forces and functions of the distance, and hence motions of remote particles can only be longitudinal with reference to the center force. This principle was rigorously demonstrated by the higher mathematics, and has been applied to numerous propositions in mechanics.

From these considerations, transversal vibrations at a considerable distance from a radiant seem impossible; hence, as the ether is supposed to be substantial, the vibrations of its particles must be longitudinal, and if light can be polarized, why not undulations generally? These notions appear to have produced a profound and persistent impression upon the mind of Prof. Robinson, who, eight years ago, became convinced of the possibility of the polarization of sound. At two different periods apparatus was made for putting the subject to experimental test; first about six years ago, and again about two years ago. The first apparatus was not put to careful experiment at once for want of time, but the latter was subjected to thorough and extended experiment. Happily these experiments verified all the above notions, without however developing new facts or theories. In the following we describe the apparatus used, and give the results of Prof. Robinson's investigation:

The means adopted for polarizing the undulations is the same as that for polarizing light by reflection. It is well known that when sound passes from one medium into another whose velocity of sound transmission differs, the sound is refracted. Recent investigations of Henry, Tyndall and others, have indicated that when sound encounters a change of density of medium, as when passing from clear atmosphere into a wall of fog, there is a reflection of sound. Altogether, there seems no doubt but sound acts like light in these respects—that is, on meeting a change of refractive power, it is both reflected and refracted, as light is at the surface of water or of glass. The reflected light is always more or less completely polarized by the reflection, and perfectly so for a certain angle called the polarizing angle. For this the reflected and refracted components are at right angles to each other. The reflected sound is also supposed to be similarly polarized.

Applying the laws of Fresnel and Brewster, 1st, that the index of refraction is equal to the ratio of the velocities of the waves in the media; and 2d, that complete polarization is obtained for the particular case of right angled reflected and refracted component rays,

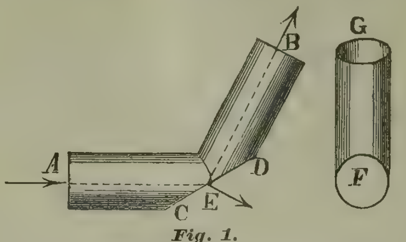


Fig. 1.

we are guided to the proper conditions. We conclude that any two substances having different velocities of propagation of waves may be selected. For instance, two gases (like hydrogen and air), any two liquids, any two solids, a solid and a gas, or, generally, any two media whatever. Considerations of convenience would indicate air and illuminating gas; and these were chosen for the present purpose. The velocities of propagation in air and coal gas being as 1,125 and 1,420, the index of refraction, according to the first law above, is $n=1.26$. The second law gives for the polarizing angle of incidence, tanget $i=n=1.26$, or $i=51\frac{3}{4}°$, the rays or waves being in the gas. To realize this incidence upon a surface of separation between the gas and air, the coal gas was placed in L-shaped tubes A B, Fig. 1, having a portion cut away at the angle, as shown at C D. The branches of the L make equal angles of $51\frac{3}{4}°$ with the normal to C D. A delicate membrane was gummed to the tube covering the opening at C D, also shown at F, the object of which was to retain the gas and maintain a polarizing surface C D. The arrow at A indicates a ray which is incident at E, and is then in part refracted outward at E in a direction perpendicular to the reflected component E B. Each tube was about 1 inch in diameter and 3 inches long. A number of these were made of tin, each with one end slightly larger than the other, so that they could be joined up, stove-pipe fashion, to any extent desired. The branches of the tubes were cylindrical, so that they could be arranged in one plane or in different planes, as desired in any polarizing test.

To use these tubes intelligibly, it must be remembered that in experiments on polarized light, a polarizer is used to polarize the light, and an analyzer is then necessary by which to examine the light, to determine the fact and degree of polarization. The unaided eye is usually not able to detect the condition called polarized; and hence the necessity for the analyzer. But in light the analyzer is always simply a polarizer in its nature—that is, two polarizers, exactly alike, may be employed, one for the polarizer and the other for the analyzer, or they may even be interchanged. Light polarized by reflection may be analyzed or examined by a second similar reflector.

Hence, in experiments in sound polarization, we must have the polarizer and analyzer, but they may be similar, or even identical. Several different arrangements of the L tubes were tried with success, each having a representative experiment in light. It is to be observed that the object is continually to treat the question of polarization here just as in light, so as to place light and sound upon the same basis.

The apparatus finally adopted for use in the verifying experiments is shown in Fig. 2. A different number of L pieces were used at different times. The portion A B is the polarizer, and B C the analyzer. The joint at B was kept tight with beeswax; the end at A and C were capped square with the same membrane material as were the angles of the Ls, giving, when charged with illuminating gas, a continuous zigzag column from A to C. The L pieces of the polarizer enter half Ls at A and B, the latter having a common axis and resting in bearings at A and B in the standards, as shown. The object of this is to enable the experimenter to turn the polarizer readily from cross to parallel, etc. This convenient arrangement of the polarizer is due to Mr. Wright, Prof. Robinson's assistant. Although applied to the polarizer, it is evidently equally applicable to the analyzer instead. The half L angles were not covered with membranes, but left solid, with gradual inside curvature. Membranes might have been applied here with partial polarizing effect. The half L solid angles are supposed to have detracted in a measure from the percentages of polarization obtained; but this sacrifice is more than compensated for by the greater convenience and constancy of conditions obtained. If this arrangement gives decisive results, of course more perfect apparatus would. The illuminating gas was admitted by a nipple and rubber hose at C, the same flowing the length of the tubes and issuing in a small jet at H. An assistant kept this ignited and used the flame length as a pressure indicator, and it served admirably.

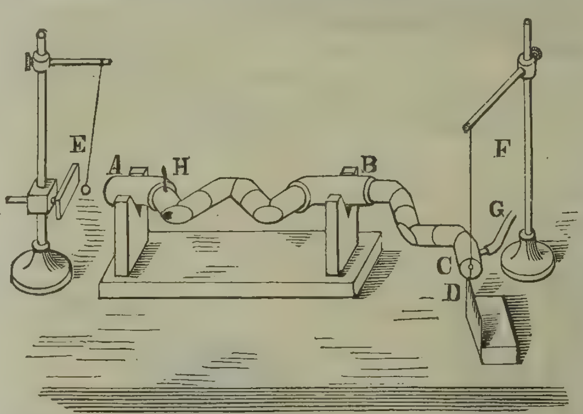


Fig. 2.

The first trials were made by blowing an organ pipe in front of the membrane A, to agitate the gas column. A small mirror was attached to the membrane C, reflecting a pencil of light upon a screen. The deportment of the image indicated complex and inadmissable vibratory movements of the gas column, and besides quantitative indication was found preferable to qualitative; thereupon the quantitative impulse and indicator pendulums were adopted, as shown at E and F respectively, Fig. 2. An ivory ball, ½ inch in diameter, suspended by a thread 8 inches in length, was used at E, and so placed that when at rest the ball would just touch the membrane at A. The impulse was imparted by bringing the ball back against the stop, shown by means of a spatula held in the hand, and then allowing it to swing free against the membrane, each time with a definite, predetermined arc. So much of the impulse as reaches C knocks the pendulum F through a certain arc, the same being measured on the scale D. This pendulum was a small, hollow glass bead, suspended by a silk fiber and trained delicately against the membrane. The bob carried a pointer for the scale D.

In the experiments the ball would be dropped against A some five or ten times, at intervals of about ten seconds, the corresponding deflections at D being noted and recorded; then the polarizer would be turned 90° and like observations noted. Again, 90° would be turned off, etc.; occasionally the length of impulse arc would be changed, or more or fewer L pieces applied, and in each case a large number of observations made.

In the experiments the initial pulse seemed to be followed by a series of vibrations in rapidly decreasing

amplitudes; but it is believed that the initial pulse is equivalent to a genuine sound wave, or an undulation. Evidence of the soundness of this view is found in the fact that the velocity of sound can be satisfactorily determined by similar pulses sent through tubes of 25 or 50 feet in length. It was evident that the initial pulse only was concerned in the first swing of the pointer at D, and this only was noted for record in the experiments The results of these experiments will be given in our July number.

Electric Lamp-Lighters.

The accompanying cuts represent two forms of apparatus designed for the purpose of lighting and extinguishing lamps by electricity. The arrangement in both cases is shown in connection with the small lamps known as night lamps. Both are so constructed that the first current which passes through them lights the lamps, and the next extinguishes them. The currents can be established through several contacts, which form a galvanic circuit, in which is included the battery and the apparatus to be described.

In the base or frame on which the lamps are mounted, is placed an electro-magnet, which attracts an armature every time a current is passed through it. Attached to this armature are two straight or curved rods, which are united at their upper extremities by means of a spiral of platinum wire, which is heated to incandescence by the passage of the current.

The extinguishing arrangement of the Maégnet system, Fig. 1, consists of a bellows, which blows a current of air into the flame and so extinguishes it, as often as the rods attached to the armature of the electro-magnet press upon it and cause it to close. When the current is kept closed for a little while, the bellows empties itself, and the platinum spiral, which is now directly over the wick, becomes incandescent and ignites the lamp. In extinguishing the lamp, the current should only be maintained long enough for the purpose, as otherwise the lamp would shortly be ignited again by the platinum spiral.

In the apparatus of Rangue, shown in Fig. 2, the flame is extinguished, not by an air current as in the arrangement above described, but by means of a cap, which is caused to come down upon the burner, and which stays in place upon it until it is desired to light it again. This device has certain advantages over the other, in that it prevents the deposition of dust upon the wick and hinders the evaporation of the oil or other burning fluid in the lamp. The rods attached to the armature carry a strip or band of steel, which, by the movement of the armature, first removes the cap from the burner and makes place for the glowing platinum spiral when the lamp is to be lighted; and when it is to be extinguished, puts the cap back again upon the burner.

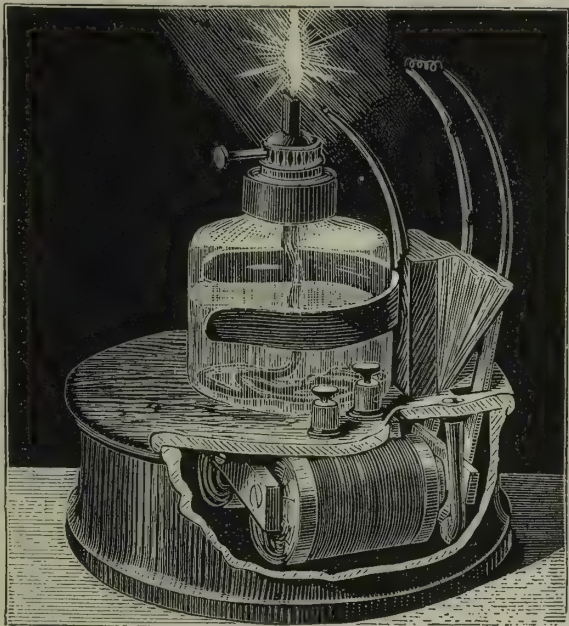


Fig. 1.—Maegnet's Electric Lamp-Lighter.

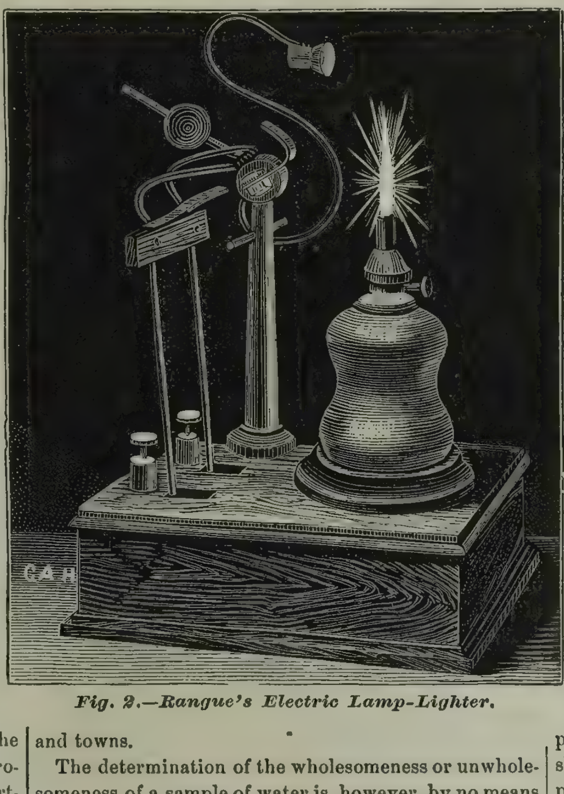


Fig. 2.—Rangue's Electric Lamp-Lighter.

Wholesome Water.

Of late years, since sanitary science has received official recognition in all civilized countries by the establishment of Health Boards and Sanitary Commissions, the question of maintaining the purity of the water supply of cities and towns has come very properly to be considered as one of the greatest importance. Few even of generally well informed people are fully aware of the immense benefits derived by the dwellers in crowded cities wherever intelligent and properly directed efforts have been put forth to prevent the pollution of the source of their water supplies, since the results accomplished do not make themselves readily manifest on the surface; but the story is told too plainly to be misunderstood, in the yearly statistical reports, wherein the record of a diminished death rate from preventable diseases bears silent but eloquent testimony to the efficacy of sanitary measures in improving the general health of crowded communities.

We do not mean in the above remarks to imply that maintenance of the purity of the water supply is to be credited with all the benefits which official sanitary supervision has conferred, since many of these are properly to be ascribed to efficient sewerage systems, the prompt and thorough removal of filth and garbage from the streets and alleys, the maintenance of general cleanliness, and the rigid enforcement of measures for preventing the spread of infectious diseases. But the preservation of the purity of the water supply must, nevertheless, be credited with a fair proportion of benefits resulting from the proper sanitary care of cities and towns.

The determination of the wholesomeness or unwholesomeness of a sample of water is, however, by no means an easy matter, since taste, smell and color do not always constitute infallible tests of its qualities; for though we may reject as unfit for use waters that contain visible impurities, or that possess a disagreeable taste or odor, these are in many cases practically harmless, when compared with others that give no outward indications of danger that may be detected by the senses, but which, nevertheless, are contaminated by the most insidious of poisons—the germs of infectious diseases. Contradictory as it may seem, therefore, a perfectly limpid water, free from disagreeable smell or taste, may be infinitely more dangerous than another that is obviously offensive to the sight, and disagreeable to the taste or smell. This apparent contradiction, however, does not alter the fact, that in a general sense, a wholesome drinking-water should be clear to the eye, pleasant to the taste, and free from offensive odor.

Perfectly pure water does not exist in nature, although rain water is so nearly pure that we may consider it so for all practical purposes; but such are the solvent powers of water, that it may be said to take up more or less of every substance with which it comes in contact. Hence it is that water that has penetrated for a considerable distance into the soil and through the crevices of the rocks, and subsequently makes its appearance upon the surface in the form of springs, or through artesian wells, etc., is generally more richly charged with mineral matters than the surface waters of rivers or of shallow wells. Such mineral constituents, which commonly consist of the carbonates (bi-carbonates), sulphates or chlorides of lime, magnesia, iron, soda or potassa, cannot be looked upon as notably injurious to health, save where present in excessive quantities; on the contrary, these and other mineral constituents in the slight quantities in which they are found in the so-called "mineral" or "thermal" waters, often have special medicinal or curative virtues which cause them to be highly esteemed. For most practical purposes, therefore, where mineral constituents in not excessive quantities are the only impurities in potable waters, they may safely be ignored.

The surface waters, such as those of lakes, rivers, etc., from which the water supply of cities and towns is generally obtained, are, however, peculiarly susceptible to quite a different species of contamination, which is productive in many cases of such pernicious results to the health of communities as to have raised the question of the purity of the water supply to the first rank among sanitary considerations. We refer here to the pollution of rivers, etc., with sewage matter, consisting largely of animal excreta, to the effects of which medical men are unanimous in ascribing the occurrence of typhoid and allied fevers, dysenteric epidemics, and the like. This is no mere opinion, but a strictly legitimate inference from a legion of observations, in which the relation between cause and effect has been ascertained beyond the possibility of a doubt.

In considering the question of the purity of the water supplies of cities and towns, we are confronted with complications of a special character—contamination from the refuse of gas works, manufactories, from the lead of the pipes in which it is served, and the like; but these forms of contamination are, taken all together, of very secondary importance when compared with the one above named. It is most fortunate, therefore, considering the almost universal practice which prevails in this country, of discharging the contents of sewers, laden with the refuse and filth of large communities, into running streams which further down are drawn upon to supply other cities and towns upon their banks with water, that nature has herself supplied what in most cases is a tolerably efficient remedy for what otherwise would prove to be a most pestilential and deadly evil, in that she has given to the running streams the power of self-purification. The movements of these bodies of water, by constantly bringing fresh portions of their load to the surface and in contact with the atmosphere, rapidly cause its destruction by oxidation, so that a river, for example, that has received the sewage impurity of a city, will, under favorable circumstances, be pure enough to drink a few miles below it. In this manner, therefore, in spite of the constant pollutions of the streams, the purifying efforts of nature are measurably effective in ameliorating the evils that would otherwise result therefrom.

The question of the proper disposal of sewage may

afford us the theme for a separate article in a future number.

Scientific.

THE SUN'S DISTANCE.—The unit of measurement in all astronomical distances, is the mean distance of the earth from the sun. Given this, the distances of the various members of the solar system are known with accuracy, and even those of some of the nearest fixed stars can be fairly approximated. This unit is generally expressed by the phrase, "the solar parallax," or angle subtended at the center of the sun by the earth's equatorial radius. M. Faye has just communicated to the French Academy a paper on the actual state of our knowledge of the sun's parallax.

He considers that there is no other scientific constant, the determination of which depends on an equal number of results completely independent of one another, and obtained by methods so totally different, and subdivides the various values assigned for the sun's mean parallax as follows:

″ *Geometrical Methods*, 8″.82.
8.85 by Mars (Cassini's method), Newcomb.
8.79 by Venus, 1769 (Halley's method), Powalky.
8.81 by Venus, 1874 (Halley's method), Tupman.
8.87 by Flora (Galle's method), Galle.
8.79 by Juno (Galle's method), Lindsay.

″ *Mechanical Methods*, 8″.83.
8.81 by the Lunar inequality (Laplace's method), ——
8.85 by the monthly equation of the earth, Leverrier.
8.83 by the perturbations of Venus and Mars, Leverrier.

″ *Physical Methods*, 8″.81.
8.799 Velocity of light (Fizeau's method), Cornu.
8.813 Velocity of light (Foucault's method), Michelson.

After explaining the value of the figures thus read, M. Faye gives his preference to the physical result, and arrives at these conclusions: 1. That the method of the physicists is superior to all others, and ought to be substituted. 2. That the value of solar parallax, $8''{}^{8}/_{13}$ (by physical methods), is now determined to about one-100th of a second. 3. That the seven astronomical methods of procedure converge more and more toward that value, and tend to confirm it without equaling it in precision.

In other words, M. Faye believes that the true distance of the sun is that found recently by Lieutenant Michelson. This value is practically the same as that adopted by Laplace in his great work, the "Mecanique Celeste."

ABSORPTIVE POWER OF CHARCOAL.—The remarkable quality which charcoal possesses of absorbing many times its own volume of various gases, renders it a most valuable substance for removing and rendering harmless the noxious emanations given off by decomposing animal or vegetable bodies. The absorptive capacity of charcoal will be best appreciated by an inspection of the accompanying tabular statement, which is given on the authority of that eminent savant M. de Sassure. His experiments were conducted with blocks of freshly burnt boxwood charcoal. He found, when this material was brought in contact with the gases below named, they were absorbed in the following proportions:

Ammonia	90	volumes.
Hydrochloric acid gas	85	"
Sulphurous acid	65	"
Sulphuretted hydrogen	55	"
Nitrous oxide	40	"
Carbonic acid	35	"
Carbonic oxide	9.42	"
Oxygen	9.25	"
Nitrogen	6.50	"
Carburetted hydrogen	5	"
Hydrogen	1.75	"

This prodigious absorptive power explains the special virtue of charcoal when strewn about a locality laden with offensive smelling gases of putrefaction, of speedily checking the nuisance. It will be observed by inspecting the above table, that the very gases that give to decomposing organic matters their peculiar offensiveness, are most eagerly absorbed.

Another point worthy of special notice is the fact that charcoal has a greater absorptive capacity for oxygen than for nitrogen; and this fact has suggested the thought that it might be taken advantage of as a means of obtaining large supplies of comparatively pure oxygen from the air. Thus far, however, no efforts have been made to test the practicability of this method on a large scale, though there can be no question that it might lead to highly important industrial applications should it prove successful.

That our readers may better appreciate this peculiar property of charcoal, we will add in conclusion, that to effect an equal condensation of ammonia to that which charcoal is enabled to condense within its pores, would require the gas to be submitted to a pressure of about 1,260 pounds to the square inch; and to effect an equal condensation of oxygen, the exertion of 126 pounds pressure.

LIME AS A PRESERVATIVE OF WOOD.—The French method of preserving wood by the application of lime, is said to be found to work well. The plan is to pile the planks in a tank and to put over all a layer of quicklime, which is gradually slaked with water. Timber for mines requires about a week to be thoroughly impregnated, and other wood more or less time, according to its thickness. The material, it is stated, acquires remarkable consistency and hardness on being subjected to this simple process, and the assertion is made that it will never rot. Beechwood prepared in this way for hammers and other tools for iron works, is found to acquire the hardness of oak, without parting with any of its well-known elasticity or toughness, and it also lasts longer.

The above statement, which we notice in a number of the technical papers, is apparently worthy of some consideration, as it is confirmatory of numerous statements to the same effect that we have met elsewhere. The plan is exceedingly simple, requiring no special apparatus to carry out, and has the merit of being cheap. It has long been known that wood set in mortar is preserved against decay, and it is somewhat singular that no systematic attempts to utilize this knowledge have yet been made. One of the naval journals not long ago contained the statement that some forty years ago a coasting schooner, built of unseasoned Maine timber, and loaded with lime, went ashore and bilged. This vessel was raised some time afterwards and is still in service. Vessels employed in carrying lime, the same journal remarks, will last longer than others.

The most interesting case in point, however, is made out by a writer in the now discontinued London *Mechanic's Magazine*. It relates the history of a platform of nine planks used for mixing mortar. It had been used for this purpose by father, son and grandson, and finally, being no longer needed, was suffered to remain on the ground and became overgrown with grass; but after a period of over sixty years the planks were again brought to light, and were found to be still in a state of perfect preservation.

The French method given above appears to be especially adapted for wood employed for architectural and other special uses where the methods of impregnation with creosote and metallic salts would be objectionable. We have met with similar favorable statements respecting the value of borax, which appear likewise to be well substantiated.

THE PARIS ELECTRICAL EXHIBITION.—The forthcoming International Congress of Electricians and Exhibition of Electrical Appliances and Apparatus, to be held in Paris during the months of August and September of the present year, promise to be events of great importance to the progress of this interesting branch of applied science. We have several times referred to the fact that such an exhibition would be held, and expressed the hope that the United States would be creditably represented thereat. Congress, however, has taken no action respecting the appointment of a suitable paid commission to fitly look after the interests of this country in connection with the exhibition, and that which will be done will be accomplished by the voluntary efforts of our present Consul-General at Paris, whose labors are being seconded as far as possible by the Department of State.

The exhibition promises to afford the most complete and valuable demonstration of the respective merits of the several rival electric lighting systems that has yet been made. The following is the order of classification announced by the authorities: 1. Production of electricity. 2. Transmission of electricity. 3. Electrometry. 4. Applications of electricity. 5. General mechanism, including applications to electric purposes. 6. Bibliography and history. As will be noticed, this classification embraces all inventions and applications of electricity to science, the arts, manufactures, navigation, commerce and telegraphy. Intending American exhibitors should address the Assistant Secretary of State, Washington, D. C., for special information.

POPULATION AND ALTITUDE.—Dr. Gannett has prepared for the United States census some interesting facts concerning the distribution of population in the United States with respect to altitude. He has prepared the following tabular summary of his observations, which is quite instructive:

Hight above Sea Level—Feet.	Population 1870.	1880.
0— 100	7,233,550	9,152,003
100— 500	8,653,603	10,775,250
500—1,000	15,127,227	19,025,617
1,000—1,500	5,620,101	7,903,811
1,500—2,000	1,191,293	1,876,885
2,000—3,000	360,059	664,851
3,000—4,000	79,349	128,348
4,000—5,000	84,319	166,545
5,000—6,000	135,483	271,321
6,000—7,000	58,466	94,980
7,000—8,000	6,304	15,053
8,000—9,000	7,390	24,927
9,000—10,000	705	26,846
above 10,000	522	26,400

These figures show that one-fifth of the population of the United States live at an altitude less than 100 feet above sea level; another fifth at less than 500 feet, and nearly one-third below 1,000 feet; while 97 per cent of the whole population live below 2,000 feet.

UNITED MEETING OF BRITISH AND AMERICAN SCIENTISTS.—The rumor has been started that at the forthcoming meeting of the American Association for the Advancement of Science, to be held at Cincinnati in August next, a proposal will be submitted to extend an invitation to the British Association to hold their annual meeting for 1883 in this country, in conjunction with the American Association, at some place to be hereafter decided upon. This suggestion, it is added, has been received with much favor by many of the leading members of the American body in the United States and the Dominion, and the hope is expressed that the British society will find no insuperable objection in the way in departing from its usual custom of holding its annual meeting at home. There are precedents which could be urged in favor of the innovation, should it meet with opposition, inasmuch as the British Iron and Steel Institute has held several meetings in foreign countries on similar invitations. Should the suggestion bear fruit, the united meeting of British and American scientists will doubtless be one of great interest to the friends of science in the two countries.

PETROLEUM AS FUEL.—Russian engineers and technologists appear to be decidedly in advance of us in respect to the utilization of petroleum in place of coal for generating motive power of every description. In the neighborhood of the oil regions of Russia, crude petroleum is very generally used for steamboat and locomotive propulsion, as well as for other uses in generating power where coal has hitherto been employed. In heating power, petroleum is so decidedly superior to coal, that no question can be raised against its

use on the score of economy; and in all the experiments that have been made with it in this country, it has demonstrated its merits in the most satisfactory manner. Russian engineers who have occasionally visited this country, have repeatedly expressed their surprise that, in a country like ours, where such abundant supplies of petroleum are available, its advantages as a fuel have not been more fully developed. In this respect Russia, which is so far behind us in many other respects, can teach us a valuable lesson.

Effect of Electric Light on the Eyes.—An unexplained objection to the electric light arises from its alleged evil effects on the eyes. European observers state that the frequent variations in intensity to which the light is subject, give rise to sudden and frequent changes in the pupil, and, consequently, in the "accommodation" of the eye, by which is meant that alternate contraction and dilation of the pupil, by which it suits itself to the variations of light. Such a light, therefore, causes not only muscular fatigue, but also a considerable degree of blurring and indistinctness in the retinal image. The eye suffers both when the light is too dim and when it is too bright. In the former case the object must be brought close to be clearly seen, and an increased accommodative effort is called for, which in most cases results in nearsightedness. In the latter case, the simple intensity of the light produces undue contraction of the pupil, and an increase of tension within the eye.

Exercise as a Preventive and Cure for Bodily Ailments.—Dr. Felix L. Oswald makes an eloquent plea in an article published in a late issue of the *Popular Science Monthly*, for the advantages of physical exercise as a preventive of and a cure for bodily ailments. He urges it as the proper remedy, curing the symptoms by removing the cause, for some of the besetting vices of youth, which he ascribes to an excess of potential energy for which our sedentary mode of life provides no outlet. He urges, also, that in large cities parents owe their children a provision for a frequent opportunity of active exercise, just as they owe them an antiseptic diet in a malarious climate.

The Applications of Electricity in Surgery are curious and valuable. One of the latest that is recorded is the electric probe, which is reported to have proved itself a valuable acquisition to army surgeons. This instrument rings a bell when it comes in contact with a ball or other metallic substance imbedded in the tissues, and thus enables the operator to locate its position with certainty.

Engineers' Club of Philadelphia.

At a late meeting of the club, a paper was read by Col. Wm. Ludlow, inviting attention to the practical neglect in this country of military engineering. Three classes of modern naval vessels were referred to; the mailed war ship with armor 2 or 3 feet in thickness, the iron or steel cruisers, and those of the "composite" type with metal frames and wood planking. The English system of coast defence, of iron or steel plates 6½ inches thick alternating with layers of teak, was briefly described, as well as the Grasen system of chilled cast iron or steel in heavy masses of curved section. The ultimate connection between the ship-building and iron industries of the country, and the universal employment of metal in the preparation of war material, were pointed out, and the plea advanced that the construction of a naval force and of adequate defence for important harbors, was clearly demanded, not only for the protection of national interests at home and abroad, but also as the most effective means of stimulating our moribund ship-building arts into life and advancing the metal-producing and cognate industrial interests of the country.

Prof. L. M. Haupt read a paper descriptive of the deflecting armor, designed by Mr. N. B. Clark, Past Asst.-Eng. U. S. N., for sea-coast defence. The inventor's improvements are based upon the fact that it is much simpler to resist the effect of a projectile by deflecting it, than by opposing it by thick masses of inert matter, as is evinced by the "ricochetting" of a shot upon the water. He protects all the vital parts of the vessel by an iron shield, convex upward, placed below the water line, and so curved that a shot cannot strike point blank. The guns are mounted upon the back of this shield, but encased in double convex disks, which are practically invulnerable. They are worked by very ingenious but simple devices in the hold, and loaded, swabbed and run into position for firing by hydraulic pressure. It is claimed that by this means a great economy is effected in the weight of metal required for attack and defence, the vessel is more readily handled, is more seaworthy, and is invulnerable. The principle may be applied equally well to the construction of batteries for defence on shore.

Mr. H. A. Vezin presented a highly interesting description of his recent investigations of the coal and iron mines and the railroads and harbors of Southern Russia, illustrated by maps of the territory and specimens, and enlivened by many amusing and instructive anecdotes of engineering schemes and methods in that country. The coal basin where his examinations were made, is about 160 miles E. and W. by 60 miles N. and S., the coal varying in quality from very hard anthracite in the east, to very inferior gas coal in the west. The iron of the coal basin is a brown hematite, formed by the decomposition of the carbonate of iron, and poor in quality; but red hematite occurs further east, and is accessible from the coal mines. The relations of the government to the railroads, and of the latter to producers and shippers; the rude, and, notwithstanding the great cheapness of labor, the very expensive methods of transporting and shipping the coal; the extraordinary transportation of timber to that almost treeless region, and the difficulty of loading or discharging vessels in the shallow harbors, together with many other matters of information and interest connected with the iron and coal industries, were very interestingly treated.

The Algerian Inland Sea.

In his recent lecture in this city, entitled "A Cruise Along the Northern Coast of Africa," Commander Gorringe, U. S. N., stated many facts of unusual interest. He called attention to a fine enlarged map of the northern coast of Africa, to show the proximity of two portions of the globe that present the greatest contrast—the highest civilization of Europe and the almost depopulated condition of the once fertile country, with its magnificent cities and cultured people, that lies between the Great Desert and the Mediterranean Sea. This strip of land is gradually becoming more narrow, and the once great cities of the Pentapolis are nearly buried beneath the sands of the desert. The speaker alluded to the French plan of cutting a canal of 102 miles, admitting the waters of the Mediterranean into the sunken portion of the desert, at a cost of $500,000,000. "Opinions differ," he said, "as to the feasibility of cutting a canal to flood the depression and as to the results of flooding them. It is conceded that the evaporation from the flooded area would be sufficient to ameliorate the climate of Southern Tunis and reclaim for cultivation a vast region now arid and uninhabited. The soil needs only water to render it unequalled in fertility. Wherever springs or wells afford a supply for irrigation, an oasis is found yielding grain and fruit in abundance. The extremes of temperature, now very great, would be diminished. We observed in our camp on the desert, in February, 1878, a range from 20° F. at three in the morning to 86° at noon. Unable to lie still long enough to go asleep after midnight for the cold, we were almost overcome by the heat of midday. One of the great advantages to be derived from flooding the valley, would be the creation of a water-way to the southern provinces of Algeria; and this accounts for the great interest shown by the French in the subject. M. de Lesseps visited the region, and a canal would probably have been commenced had his attention not been diverted to Panama. Notwithstanding the fact that the route of the proposed canal passes through many miles of quicksands, in which caravans that have lost their way in crossing the *chottes* have been swallowed up, the French engineers regard it as entirely feasible. Doubtless they will find it as easy to control the quicksands of Africa as the floods of the Chagres in Central America. Cutting a canal 102 miles through a desert is doubtless as easy to a Frenchman as demolishing a mountain or two on the Isthmus of Panama. The estimated cost of the canal is about $500,000,000, and it does not seem to me that such an outlay would be justifiable for flooding an area of 3,000 square miles—about one-tenth of that of Lake Superior. The world is not yet so thickly peopled as to make it necessary to provide more room. We can offer to European emigrants for some years to come fertile lands for cultivation at lower rates than the promoters of the French inland sea scheme could afford to sell land reclaimed at such a cost."

Nickel in New Caledonia.

The discovery, some years ago, in the French penal colony of New Caledonia, of ore deposits rich in nickel, has led to important results in the industrial production of this metal. Up to that time, the most important nickel-producing mine in the world was the famous Gap Mine in Lancaster county, Pa., which has been successfully worked for a number of years by Mr. Joseph Wharton, whose American Nickel Works, at Camden, N. J., produced all the nickel used in this country, and even supplied to some extent the foreign demand. The ore of the Gap mine is what is known to mineralogists as a nickeliferous *phyrrotine*, being substantially a sulphide of iron carrying about 3 per cent of nickel, and is extremely difficult to work.

The deposits of New Caledonia yield an ore, which, if it is not a new mineral, is nevertheless quite new in its metallurgical relations. It is a hydrous silicate of magnesia and nickel, carrying about 10 per cent of nickel. It is of an apple or pear green color, and has been called *garnierite* (or *naumeite*). This ore is said to be quite free from traces of sulphur, arsenic, iron and copper, and if cobalt is present it is there in very minute quantities.

Since the discovery of these valuable deposits, immense quantities of the ore have been shipped to France and England. Its freedom from the above named deleterious impurities, and from bismuth, lead and antimony, which accompany the German nickel ores, renders its working comparatively easy; and this fact, in connection with the abundance and richness of the ore, has created quite as great a revolution in the industrial production of nickel as the discovery of the Australian tin deposits did for that metal. The price of nickel abroad, it is said, has fallen to some 3 or 4 shillings per pound, from 16 shillings or thereabouts, which was its old-time figure.

Nickel has been found to be applicable to many and varied uses in the arts, and all that is required to assure it a permanent position of widely extended usefulness in the industries, is the assurance that abundant supplies of the metal are available, and that it will be produced at a cheap and uniform price. On this account, therefore, much importance attaches itself to the statements which represent the New Caledonia nickel deposits to be very extensive.

Center of Population.—General Walker says that the center of population of the United States, which is now being computed, will be found to be very near Cincinnati. The center of population ten years ago was about forty-eight miles east of Cincinnati, or rather north of east. The large increase in the Southern States would give the center a slight southern course, and the growth of the great West would probably take it westwardly about fifty miles. These causes acting together will throw the center of population very near to Cincinnati—General Walker thinks within five miles, although he declines to make an estimate.

The Wheelock Engines.

The result of the competitive test of engines at the Millers' Exposition at Cincinnati last June has recently been published. The three tested were the Reynolds-Corliss of Milwaukee, the Harris-Corliss of Providence, R. I., and the Jerome Wheelock of Worcester. The expert who prepared the report does not make any award, but simply leaves his comparisons and figures to tell the story. The test has attracted much attention. Of the Wheelock engine the report says: It is a type of its own, with all the valves located below the cylinder in a common plane. This engine is a marvel of compactness and simplicity, and I might say oddity, as many of the peculiarities of the builder are reproduced in his engine. Engineers of a fastidious turn have not been disposed to recognize Mr. Wheelock as in the front rank of automatic steam engine builders. But the record made by his engine in these trials may procure for him a more respectful consideration in the future. The whole engine is extremely light, the weight, exclusive of fly wheel, being but one-half that of the "Harris," and less than half of the "Reynolds." It did not appear, however, during the trials that the reduced weight of the "Wheelock" engine rendered it less capable of resisting the load strains than either of its more celebrated competitors.

Out of twelve counts which the expert saw proper to make, the Wheelock engine was first in seven, the Harris first in four, and the Reynolds first in one. The expert's counts, in which the Wheelock engine was first, were economy in condensing; economy of condensing water; useful effect condensing; useful effect non-condensing; economy of steam, condensing water and regulation, and coefficient of useful effect; economy of steam and condensing water. The report says: The friction consumed by the Wheelock engine was remarkably small, proving it to be the lightest running, as can be seen by the following friction of engines—Wheelock 7.8, Harris 9.6, Reynolds 10.3.

The tests were made under the condition that to the best engine an award of $500 should be made; but the financial success of the Exposition being rather a failure, no awards have so far been made. It is stated that Mr. Wheelock has laid his case before the Millers' International Association, and is demanding that a public acknowledgment of his victory be made.

It should be noted that the report of the expert who superintended the trial states that the "Brown" engine was entered by C. H. Brown & Co., Fitchburg, and the "Buckeye" by the Buckeye Engine Co., of Salem, O. The "Brown" was withdrawn by "reason of real or supposed incapacity of its condenser," and the "Buckeye" because its foundation proved "inadequate for the speed at which it had to be worked, it being much lighter than the others, which were worked at three-fourths the speed of the 'Buckeye.'"

A Glimpse of City Drains.

Dr. Richardson says: "If, by some magic spell, all the drain tubes and pipes in a large city could be transformed from tubes of metal into tubes of glass, so that in every house the decomposition they cover could be made manifest to the eye, the wonder of the simplest-minded would be, not that we had disease in our houses, but that at any moment we were free from the self-inflicted curse of diseases of the most fatal nature in their worst and most mortal types and consequences. From the upper closet, through the whole of the soil, into the chief drain; from the pipe of every sink into the main drain; from the main drain at its commencement, through all its courses to the outlet trap; from the earth all around the main drainage pipe; from the exit of the main drainage pipe in the trap to the termination of the trap itself in the sewer or cesspool; in all these parts there would be seen such a line of decomposing, disease-producing material as would make every one, I think, for once declare that sanitary reform is not quite such a fanaticism as it is commonly accredited to be."

Korting's Water-Jet Condenser.

Non-condensing engines, as is well known, have the disadvantage of working against the resistance of the atmosphere, which represents a constant loss of power

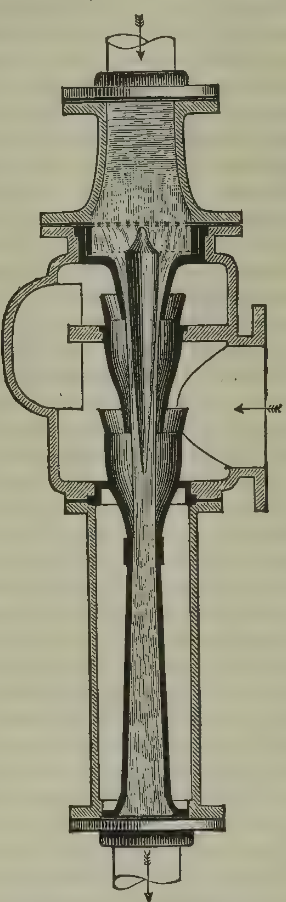


Fig. 1.—Section of Korting's Air-Jet Condenser.

estimated to be from 30 to 40 per cent. The object of the apparatus to be described below, is to counteract and neutralize this element of loss, which it accomplishes by creating and maintaining a constant vacuum

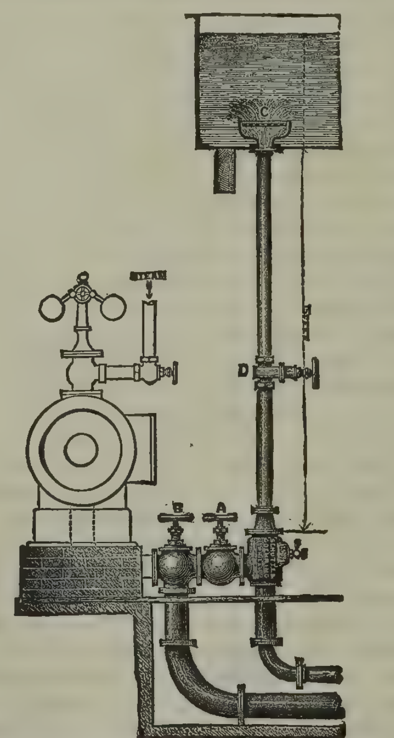


Fig. 2.—Korting's Water-Jet Condenser Connected.

on the exhaust side of the piston during its entire stroke. The advantages which this apparatus will afford, will depend on the degree of completeness and quickness with which condensation is effected, and according as the proper conditions are more or less perfectly realized, the makers affirm that an increase of from 20 to 40 per cent in the power of the engine, or a corresponding economy in fuel, can be obtained.

The apparatus is known as Korting's Water-Jet Condenser. It dispenses entirely with an air pump, on which account it is applicable to small as well as to large engines. It requires in operation about 20 to 25 times the amount of water evaporated for the use of the engine. The simplicity of the apparatus, and especially the fact above named—that it dispenses with air pumps—enables it to be used with advantage where an air pump condenser would be nearly useless from the amount of power absorbed by the air pump.

The annexed cut (Fig. 1) shows a sectional view of this condenser, the construction and action of which will appear from the following description: The water enters the condenser through an annular opening formed by a water nozzle of proper shape, which contains a long, tapering spindle, the water entering the condensing chamber in an annular ring, discharging gradually downward into a solid jet, and then to the discharge tube. By causing the water to be distributed in a thin sheet around the tapering spindle, and by the great length of jet running free through the condensing chamber, this condenser offers the largest possible condensing surface; and by the action of the jet at the mouth of the discharge tube, around the outside circumference of the jet, where the mechanical suction action takes place, it offers the greatest capacity for the discharge of air and other uncondensable vapors and gases which may have entered with the exhaust steam or water.

The object of this intermediate nozzle is to conduct the exhaust steam all around the jet downward, where the greater portion is condensed, and the remainder goes upward through the back passage and enters the upper nozzle, where it meets the water at its coldest point. By this means the completeness of the vacuum obtained with the condenser is self-evident. Attaching the well-known 33-foot tail-pipe to a condensing box, into which water is admitted in a spray or otherwise, must of necessity overcome the pressure of the atmosphere, and will, if a correct quantity of water be properly distributed and no air admitted, maintain a vacuum. To do this, however, a discharge hight of 33 feet is required, which is seldom at disposal; or if it be obtained by building into space, water will have to be brought to that hight, as also large exhaust pipes carried to that point. The objectionable features of such an arrangement, independent of the power required to convey water to a hight of 33 feet, are obvious. With the Korting condenser, a hight of 15 feet between the levels of the supply and the discharge water is fully sufficient, and a practically absolute vacuum can be obtained with this fall in a properly proportioned condenser.

Fig. 2 shows the Korting water-jet condenser properly connected. The purpose of the free exhaust valve B is to make it possible to run the engine as a non-condensing one should the water supply fail from any cause. The water-check A is a safety guard against a back-flow of the water into the cylinder of the engine, which can occur with any condenser if the vacuum in the engine cylinder is greater than that in the condenser.

These condensers are manufactured of all sizes, suitable for engines of 5 horse-power upward to the largest engines. The makers request of inquirers for condensers, a full description of engines and boilers, with the amount of fuel used. These details should include such points as the diameter of cylinder, length of stroke, steam pressure, number of revolutions per minute, point of cut-off, distance of water supply to engine, etc.

The manufacturers are Messrs. Schutte & Goehring, corner 12th and Thompson streets, Philadelphia, with branch offices at 109 Liberty street, New York, and 7 Oliver street Boston.

IRON OR STEEL immersed in a solution of carbonate of potash or soda for a few minutes, will not rust for years, not even when exposed to a damp atmosphere.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, ⅝	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch	43 a — 44
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	90 00 a 110 00
Black walnut, ⅝-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	30 00 a 35 00
White wood, ⅝ panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 00 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo,	Afloat.
Pale per M.	2 25	a 3 00
Up Rivers	6 37	a 6 62
Jersey	6 00	a 6 25
Long Island	— —	a — —
Staten Island	8 50	a 8 75
Haverstraw Bay	6 75	a 7 00
" " choice	7 25	a — —
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown per M.	10 00 a 11 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	23 00 a — —
Trenton	22 00 a 23 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2¼c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	23 50 a — —
" Glengarnock	22 00 a 22 50
" Eglinton	20 50 a 21 00
" American, No. 1	23 00 a 24 00
" American, No. 2	21 00 a 22 00
" American, forge	19 00 a 20 00

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb.	— 7 a — 8¼
Sheet, (open)	— 7½ a — 7¾

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a — —
do do No. 1, blue, in rough	— 85 a — 90
Bedford Stone	1 25 a — —
Berlin Freestone, in rough	— 75 a 1 00
Berea Freestone, in rough	— 75 a — 00
Brown Stone, Portland, Conn	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a — —
do Mary Point Brown Stone	1 00 a — —
do do Olive Stone	1 00 a — —
Brown Stone, Belleville, N. J.	1 00 a 1 35
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a — —

PAINTS.

*Carmine, American, per lb. gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags gold	— 55 a — 57 ½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,) gold	— 8¼ a — 9
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 15 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb. — 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	— 90 a — —
" finishing	1 15 a — —
Rockland, common, cargo rate	1 00 a — —
" finishing	1 10 a — —
Ground	1 00 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	2 00 a 2 25
Masons, do	3 50 a — —
Plasterers, do	3 50 a — —
Carpenters, do	3 25 a — —
Plumbers, do	3 25 a 3 50
Painters, do	3 00 a — —
Stone-Setters, do	3 00 a — —

DOORS, WINDOWS, AND BLINDS.

DOORS, RAISED PANELS, TWO SIDES.

2.0 x 6.0	1¼ inch.	$ 90	——
2.6 x 6.6	1¼	1 20	——
2.6 x 6.8	1¼	1 25	——
2.8 x 6.8	1¼	1 30	——

DOORS, MOLDED.

Size.	1¼ inches.	1½ inches.	1¾ inches.
2.0 x 6.0	$1 48	——	——
2.6 x 6.6	1 56	1 95	——
2.6 x 6.8	1 80	2 28	——
2.6 x 6.10	1 83	2 33	——
2.6 x 7.0	1 97	2 36	——
3.8 x 6.8	1 88	2 39	3 33
2.8 x 7.0	2 04	2 46	3 46
2.10 x 6.10	1 98	2 54	3 56
2.0 x 7.0	2 21	2 69	3 80

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	24 a —
Up to 3.1 wide	26 a —
Up to 3.4 wide	28 a —

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	53 a — —
Per lineal foot, 4 folds, ash or chestnut	— 77 a — —
Per lineal foot, 4 folds, cherry or butternut	— 96 a — —
Per lineal foot, 4 folds, black walnut	1 08 a — —

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 a — —

REVIEW OF THE MARKETS.—In the lumber market business has fallen into a sort of rut, from which it has been difficult to draw many new features of interest from week to week. Trade has been good all around. Supplies have generally been selling close to the offering, especially for near-by delivery, and prices well maintained for all attractive goods and assortments. In fact, it has been a good, healthy and cheerful market, with no reason to expect the favorable elements will vanish for some time to come.

In the brick market the strength lately shown for common hards has been well maintained, and prices have been gradually working upward, until there has been a considerable advance established, with still a little buoyancy shown.

In the cement market the supply of foreign brands coming to hand has been very full, but a considerable portion went out at once on contract, and what remains does not appear to worry holders much in view of the continued good inquiry for all attractive stock. Domestic has been selling well, and prices well maintained.

In the lath market demand has been very good, and afforded an outlet for the few additions to the supply as fast as they came to hand.

In the lime market there has been a good demand, and only a scant offering of stock as compared with the outlet, which has kept the advantage well in sellers' favor.

In the hardware market demand has shown an absence of animation, and has been confined in the main to small parcels required for immediate use. Indeed, on general hardware it is believed that trade must rule dull until the fall season, and dealers generally are much discouraged. Values have been somewhat unsettled, but no important changes are contemplated for the present.

In the metal markets manufactured iron has been selling fairly, and a full and steady demand is noted. American pig has been delivered with some freedom on contract, as the consumption has been full in the execution of all orders. Very little new demand has developed, however, and general business has shown a decidedly slow and stupid tone. Domestic pig lead was tending upward at one time, but this checked demand and holders afterward offered easier terms again, with the tone at the time somewhat unsettled. There has been a pretty full amount of stock available and most dealers willing to negotiate. Pig tin has found only a moderate and uncertain outlet, with most of the offering coming from outside holders anxious to unload. For a time prices were fairly maintained, but subsequently developed considerable weakness. Tin plates have moved slowly, and principally in jobbing lots, with the advantage in favor of the buyer, though openly no important concessions named. Nails have shown considerable irregularity, and demand has been moderate from all sources.

In the paint market demand has fluctuated somewhat, but on the whole has preserved a good average total, and the market at the present writing appears to be in a highly satisfactory condition.

Heating Buildings by Steam.

Of late years the plan of heating buildings by means of steam, which at first was specially confined to buildings used for manufacturing purposes, has come into great popularity, and at present is very generally adopted in our cities and towns for heating large buildings of every description, and to some extent has been introduced into private dwellings.

The plan of heating by steam where the size of the building and other conditions are such as to warrant the expense of introducing the plant, a steam boiler of sufficient capacity, with its accessories, a system of pipes, etc., has many advantages to recommend it. One great convenience afforded by steam-heating apparatus, is the ease with which the pipes may be carried in every direction. It is only necessary to provide means for carrying off the water that condenses in them, in order to keep the line of pipe free from obstruction, and this being assured, the pipes may be carried at pleasure above or below the boiler to any reasonable extent. Wherever, in a system of steam-heating pipes, there are considerable alterations of level, the condensed water must have an outlet from the lowest part, otherwise the pipes will become choked with water, and consequently inoperative. While in theory there is nothing to hinder the introduction of the most sudden and eccentric alterations of level, yet in practice they present real difficulties, inasmuch as every sudden dip or alteration of level will require a separate provision to be made for the removal of the water which will condense at such points. Hence in practice such sudden dips are to be as far as possible avoided, and the pipes should be laid with a small but gradual inclination, so that the condensed water may flow out at one place, or at least from as few places as possible.

The efficient removal of the condensed water is important on another account, since, if this is not carried off by suitable outlets provided, not only will the pipes be clogged, but there is great liability, where portions of the system are of cast iron, that these may be broken. In all the modes of steam heating in use, however, the makers have fully appreciated these elementary difficulties, and have provided against them more or less effectively.

In introducing steam-heating apparatus into a building, the first question of importance to determine is the quantity of heating surface that will be required. This factor will of course be modified by the pressure under which the steam is delivered from the boiler. The earlier practice in this respect was to use very low pressures, but at the present time steam at 5 to 10 or even 20 pounds pressure per square inch is not uncommonly in use for heating buildings of every description. Of course the higher the pressure the higher will be the temperature of the pipes and other radiating surfaces, and the smaller the quantity of radiating surface that will be required to produce a given heating effect. In heating factory and other buildings where steam power is in use for other purposes, the surplus steam from the boilers, or the exhaust steam passing from the engine, may be utilized for the wants of a steam-heating apparatus. For other situations, a separate steam boiler is required for the purpose.

In determining the amount of radiating surface necessary to heat to a comfortable temperature (say 60° to 65° F.), certain well understood and universally applicable rules have found general acceptance among the manufacturers of this class of apparatus. To enter into these would consume more of our space than we contemplate devoting to the subject in this issue. We will only add, in this connection, that in apportioning the boiler for heating a given line of pipe, the best authorities agree in assuming that the steam space of the boiler, where it is designed to use steam of low pressure, should be about equal to the area of the pipes, so that the pipes may be easily filled with steam when the valves are opened. This rule, however, will not apply satisfactorily to modern practice, for the reason that the policy of using steam of much higher pressure than was formerly in vogue, is now very generally approved and adopted. The modern practice of higher pressures is the outgrowth of the very general demand for steam heating on the score of its convenience and serviceability in situations where the introduction of boilers of large capacity, which would be demanded with low pressures, would be inconvenient. It scarcely needs to be remarked in this connection, that the boiler of a steam-heating system should be of sufficient capacity to evaporate as much water for an hour as the pipes will condense in the same time. In practice, however, it is important to note that a considerable allowance—that is, an excess of heating surface in the boiler—should always be made.

Before leaving the subject of the proper requirements of a steam-heating plant, it should be mentioned that effective means must be provided for the prompt removal of the air which is contained in the pipes, because if this is not provided for, a portion of the pipe line will remain filled with this confined air, and will remain cool until it is gradually removed. To provide against this difficulty, a blow-off cock is generally placed between the boiler and the pipes which heat the building. On opening this cock, the steam should drive before it all the air which was contained in the pipes. Where the pipes are laid horizontally, but little difficulty will be experienced in getting rid of the confined air by opening the blow-off cock at the further extremity of the line when the pipes are about to be heated. But when the heating surfaces occupy several different levels, and when, as is frequently the case, they assume the form of coils, steam plates, ornamental columns or radiators, special eduction pipes or valves should be provided for expelling the confined air, which is usually done. For removing the water of condensation, automatic steam traps in variety have been devised, many of which are very efficient, and leave little to be desired.

The advantages of a steam apparatus over a hot water apparatus, consist in the greater ease with which the former system may be applied to situations where great inequalities of level, and frequent alterations of level occur, and especially where the boiler is necessarily placed at a higher level than the apartments that are to be heated. Furthermore, steam possesses a decidedly greater ease of circulation over hot water, for while the temperature of a set of hot-water pipes cannot be regained until the water has made its entire round, the temperature of a set of steam pipes can readily be maintained throughout one entire line of pipe, and as rapidly as the temperature falls below 212°, it speedily re-establishes itself.

Finally, on the score of wholesomeness, steam heating leaves nothing to be desired, and wherever the introduction of the system is permissable, it is to be recommended.

Houghton's Vegetable Boiler and Tube Compound.

The evil effects resulting from the use of impure water for supplying steam boilers have been repeatedly dwelt upon in this journal, and in this place we may avoid a repetition of details already presented, by summarizing the conclusions that all steam users will admit to be warranted by the facts, which most of them have experienced to their cost. These conclusions, briefly stated, are that feeding with impure water causes incrustation; this in turn, by imposing a non-conducting surface between the fire surfaces and the water, requires the expenditure of a largely increased amount of fuel to produce the same steaming effect; and this in turn gives rise, where the evil exists in aggravated form, to the dangerous overheating and consequent weakening of the plates, and predisposes the boiler to the risk of explosion.

Several methods are prescribed for avoiding these evils. The first and most effectual, of course, is the use of pure water. This, however, is practically evading the issue, for in the great majority of cases it is quite impossible to obtain, and steam users must use what they can get. The second plan consists in the use of various artifices for purifying the water before it enters the boiler. This plan may be either a chemical or a mechanical one. The chemical method premises a reservoir into which the water supply is received, and the addition to the water of certain chemical substances which shall precipitate or carry down in solid form the impurities which it contains. This method is rarely practiced.

The mechanical method involves the use of what are generally called feed-water heaters and purifiers. These are constructed of various forms, and a number have been described in the pages of this journal. They are very serviceable, and are deservedly popular with steam users.

The third plan consists in the addition to the feed-water of certain substances, which shall act, either chemically or otherwise, to prevent the lodgement and attachment of the scale-forming ingredients upon the plates and tubes and other interior surfaces. Where these materials are not of a nature to act corrosively upon the metal of the boiler, they are frequently very serviceable, and some that have demonstrated their utility have come into very general use.

Our attention has been directed to a compound for this purpose which has acquired an excellent reputation for effectiveness. It is known as Houghton's Vegetable Boiler and Tube Compound, and is designed for use in all forms of boilers—land and marine. This compound, as the name indicates, is represented to be of vegetable origin, and its action is said to result in coating the interior surfaces of the boiler with a smooth varnish-like surface, to which no sediment or scale will adhere. The preparation is guaranteed by the makers to entirely remove all scale from boilers without injuring the metal, and to prevent foaming.

We have had no means of making a personal examination of the claims of the manufacturers, but from the inspection of a circular that has come to us, we find a large number of testimonials as to the efficiency of the preparation, which would appear to substantiate their claims. One of these, from General Newton, well known to our readers as the Superintending Engineer of the Hell Gate improvements, we reproduce, because of the eminent reputation of its author:

"UNITED STATES ENGINEER'S OFFICE,
ROOM 31 ARMY BUILDING, COR. HOUSTON AND GREENE STS.,
NEW YORK, July 23, 1873.

"DR. R. J. HOUGHTON:

"*Sir:* Your boiler and tube compound was used at Sandy Hook about a year ago, and on the same boiler several times since, and it has removed the scale and glazed the surface of the shell and tubes. It is in general use at Hallet's Point, where the deposit in the boiler was very thick and proving destructive; but since your compound was introduced, the scale is gradually being loosened and worked off, and no new formation of scale has been noticed on such parts of the boilers. Yours respectfully, JOHN NEWTON,

"*Lieut.-Col. Eng'rs, Brvt. Major-Gen.*"

From the tenor of this endorsement, our readers may draw their own inferences as to the value of Mr. Houghton's preparation.

Full information may be obtained by addressing the manufacturers, Messrs. Houghton & Co., 15 Hudson and 130 Reade streets, New York.

SPECULATION IN MEXICO.—Speaking of the great attention now being attracted to the development of the resources of Mexico, a correspondent of the *Engineering and Mining Journal* utters some timely words of warning to Americans who are growing enthusiastic over the subject. He recalls the fact that in 1824 the English made a grand rush into Mexico. Of the scores of companies then formed, not one remains—they all went under. The same thing was repeated in 1864, when a rush took place from California. The disasters of these two periods, this correspondent thinks, will be certain to be repeated on a large scale. In short, he predicts the Mexican boom, like all the other booms, will wreck a great many adventurers and carry a few to fortune.

Home Department.

Raw Oysters.

Dr. William Roberts, in an interesting series of lectures on digestive ferments, published in the *Lancet*, says: "The practice of cooking is not equally necessary in regard to all articles of food. There are important differences in this respect, and it is interesting to note how correctly the experience of mankind has guided them in this matter. The articles of food which we still use in the uncooked state are comparatively few, and it is not difficult in each case to indicate the reason of the exemption. Fruits, which we consume largely in the raw state, owe their dietetic value chiefly to the sugar which they contain; but sugar is not altered by cooking. Milk is consumed by us both cooked and uncooked, indifferently, and experiment justifies this indifference, for I have found on trial that the digestion of milk by pancreatic extract was not appreciably hastened by previously boiling the milk. Our practice in regard to the oyster is quite exceptional, and furnishes a striking example of the general correctness of the popular judgment on dietetic questions. The oyster is almost the only animal substance which we eat habitually, and by preference, in the raw or uncooked state, and it is interesting to know that there is a sound physiological reason at the bottom of this preference. The fawn-colored mass which constitutes the dainty part of the oyster is its liver, and this is little else than a heap of glycogen. Associated with the glycogen, but withheld from actual contact with it during life, is its appropriative digestive ferment—the hepatic diastase. The mere crushing of the dainty morsel between the teeth brings these two bodies together, and the glycogen is at once digested, without other help, by its own diastase. The oyster in the uncooked state, or merely warmed, is, in fact, self-digestive. But the advantage of this provision is wholly lost by cooking, for the heat employed immediately destroys the associated ferment, and a cooked oyster has to be digested, like any other food, by the eater's own digestive powers."

The Young Mechanic.

Some young men have queer taste. They would sooner deal out tea and sugar, fish up mackerel or draw syrup than to become a mechanic. They deem it more desirable and more honorable to measure calico, to sell tape and pins and needles, than to become an industrious and advancing workman in a shop or factory.

To the intelligent, hopeful, diligent mechanic there is a promising future. Boundless possibilities stretch out before him. Fortune and fame beckon him onward in his career. If in his struggle to mount high the ladder of his chosen calling he finds that his hands are soiled, it matters not; he realizes that a stain upon the hands is indeed better than a stain upon the reputation. There is a wide gulf between the position of the clerk, who is a mere drudge in a store, and the young mechanic whose brain is active with inventive thought. We mean no disparagement to the clerk, but the chances for improvement and advancement are so immeasurably greater to the mechanic than the mere salesman that the two seem separated by an almost impassable distance. The world is crowded with cheap clerks and worthless dandies, but there is a lack of young mechanics. In the workshops of the land there is plenty of room for young men of the right mettle. They will be well paid, and will find opening before them, in every direction, avenues of advancement.

The young man who enters life's real duties in possession of a good mechanical education, goes backed by a fortune which cannot be lost or taken from him.

To Make Modeling Clay.—Knead dry clay with glycerine instead of water, and a mass is obtained which continues moist and plastic for a length of time. This removes one of the greatest inconveniences that is experienced by the modeler.

Improved Sanitary Appliances.

From the great variety of improved sanitary appliances illustrated in the catalogue of the Jennings Sanitary Depot, we have been permitted to select for description several articles of this class which appear to possess the combined merits of notable simplicity and utility.

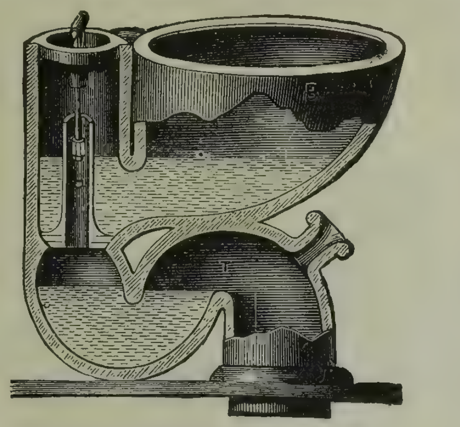


Fig. 1.—Jennings' Water-Closet.

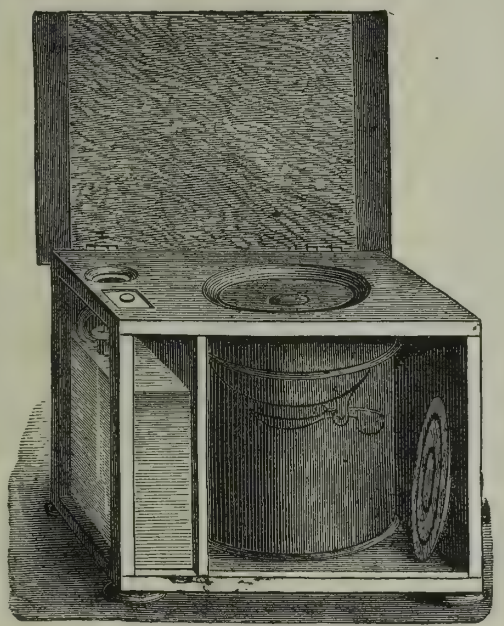


Fig. 2.—Portable Water-Closet.

Fig. 1 represents one of several forms of water-closet, for the excellence of which this establishment has become widely known throughout the country. It combines valve, water-closet and trap in a simple and effective manner, and can be safely recommended to all who require a good and reliable apparatus of this kind, which shall not be liable to get out of order. It supplies a regulated quantity of water, ample for flushing the basin, simultaneously with the raising of the handle; the valve is operated by a float valve, which insures an invariable supply of water to the basin; its construction is exceedingly simple, and all parts being above the floor, are readily accessible for examination. In addition to these desirable features, it may be stated that the supply valve can be adjusted to suit any water pressure that may be given. The body of the basin is entirely of earthenware, complete in one piece. The discharge of closet paper is made directly into the trap, and the use of the iron receiver is dispensed with, which is a great objection in pan closets, as it permits of the accumulation of sewer gases therein above the trap. A ventilating socket is provided with these closets, for the purpose of attaching a ventilating pipe, should it be deemed desirable. It is shown in the cut, below the basin on the right, and if not intended to be used is kept tightly plugged. These closets have been very extensively introduced in Europe and in this country.

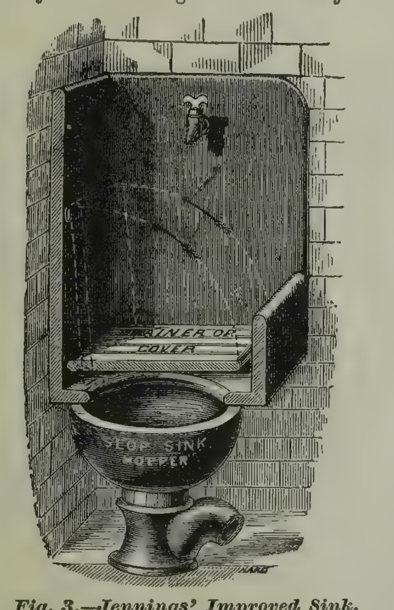


Fig. 3.—Jennings' Improved Sink.

Fig. 2 represents a form of portable water-closet, the convenience of which in the household will require no explanation. It will be especially appreciated by invalids, for whom the usual water-closet is often inconvenient of access, and has the advantage of freedom from offensiveness in the sick chamber, which is a serious objection to the ordinary commode. This portable closet is specially designed for its peculiar service. It is made to operate with the minimum quantity of water; the basin is kept clean, and its mechanism is so simple and substantial that it cannot well get out of order.

Fig. 3 represents the Jennings patent sink. These are made of various sizes and shapes, to fit into any angle, recess or other position where they may be required. They are made of plain or enameled slate, as may be ordered.

Further information respecting these, and a great variety of other sanitary appliances, may be had on application to Jennings' Sanitary Depot, Alfred E. Jennings proprietor, 7 Burling Slip, New York.

Keep a Little Ahead.

One of the grand secrets of success in life is to keep ahead in all ways possible. If you once fall behind it may be very difficult to make up the headway which is lost. One who begins with putting aside some part of his earnings, however small, and keeps it up for a number of years, is likely to become rich before he dies. One who inherits property, and goes on year by year spending a little more than his income, will become poor if he lives long enough. Living beyond their means has brought multitudes of persons to ruin in our generation. It is the cause of nine-tenths of all the defalcations which have disgraced the age.* Bankers and business men in general do not often help themselves to other people's money until their own funds begin to fall off, and their expenditures exceeds their receipts. A man who is in debt walks in the midst of perils. It cannot but impair a man's self-respect to know that he is living at the expense of others. It is also very desirable that we should keep somewhat ahead in our work. This may not be possible in all cases, as for instance when a man's work is assigned to certain fixed hours, like the operatives in a mill. But there are certain classes of people who can choose their time for the work which they are called to do, and amongst them there are some who invariably put off the task assigned them as long as possible, and then come to its performance hurried, perplexed, anxious, confused—in such a state of mind as certainly unfits them for doing their best work. Get ahead and keep ahead, and your success is tolerably sure.

Comparative Longevity in the Professions.—Eschnit has confirmed, by a new statistical table—showing the duration of life in the various professions in Bavaria—the general impression that medical men are shorter lived than any other class. Out of every 100

individuals, 53 Protestant clergymen, 41 professors, 39 lawyers or magistrates, 34 Catholic priests, but only 26 doctors reach the age of 50.

The Manhattan Beach Railroad.

The Manhattan Beach Railroad was opened for the season on the 26th of May, with improved facilities for the travelling public. The boats leave Twenty-third street, East River, connecting with train at Greenpoint, hourly from 9.45 A. M. during the day, and from pier foot of Whitehall street, hourly from 9.10 A. M. The daily papers will show any change during the season. We are pleased to note the company have made improvements in their cars for the convenience of their patrons, while their rolling stock cannot be surpassed by any line running to Coney Island. The facilities have been improved and extended, and visitors are reasonably sure to be at the beach on time. This railroad makes the only connection by rail with the New York Jockey Club race course at Sheepshead Bay which is acknowledged to be the finest race course in the country, if not in the world, many thousands of dollars having been spent in improving the property and beautifying the grounds. The season at this course opens on the 15th of June, continuing several days, and will be patronized by the best people in New York and vicinity. The property and hotels at the Coney Island terminus have been much improved since last season, and the bathing facilities are the best ever offered the public. The hotels, the Oriental and Manhattan are considered to be the best afforded by any watering place in the country. The grounds have been beautified, and all surroundings put in thorough order for the entertainment of guests. All this tends to attract the best class of people over the Manhattan Beach Railway. We have been a constant patron of this line, and always found the officers courteous and attentive. We predict for the road a prosperous season, and take pleasure in calling the attention of our friends and patrons to this line and recommend a trip over it by every one visiting New York.

Forest Culture.

Probably fifty years hence there will be abundance of trees in the West. Agriculturalists are rapidly awaking to the necessity of planting them. The Fort Scott and Gulf Railroad Company has begun the planting of hundreds of acres of trees on its lands. A Boston capitalist has engaged a company of raisers of forest seedlings in Illinois to break and plough a large area in Kansas, and plant no less than 2,720 trees to the acre, and cultivate these until they shade the ground. At the end of that time—say ten years—the plantations will be delivered over to the owner. No trees less than six feet high are to be counted. The Fort Scott Railroad has adopted this plan, one advantage of which is that the tree enterprise will be attended by experienced men, whose interest it will be to make as much of a success of it as possible.

The Australian Museum.

We have received from Mr. Charles R. Buckland, Secretary of the Board of Trustees, a number of circulars describing the plans for the formation of a permanent technological, industrial and sanitary museum in Sydney, New South Wales, which is designed, according to the terms of the documents before us, "to occupy a similar position and fulfill the same purpose in that colony, which the South Kensington Museum, the Bethnal Green Museum, the Museum of Practical Geology, the Patent Office Museum and the Parkes Museum of Hygiene, do in London."

For this purpose, the projectors are preparing to get together typical collections of all materials of economic value pertaining to the animal, vegetable and mineral kingdoms, from the raw material through the various stages of manufacture to the finished products.

The trustees of this projected museum announce their expectation of securing the use of the present International Exhibition Building in Sydney for their purpose, and ask the co-operation of manufacturers and others in furthering their plans, by sending for display in the Museum specimens of manufactured products, showing the various stages of manufacture they pass through, etc. Many exhibitors at the Sydney Exhibition have announced their willingness to allow their exhibits to remain, and these will form a valuable nucleus about which to accumulate fresh and valuable material. As Australia offers one of the most promising and profitable fields for American manufacturers to cultivate for the introduction of American goods, it may not be amiss for them to take advantage of the opportunity to be fully represented by samples of their productions in the projected Australian Museum.

All necessary information respecting the manner of shipping packages to the Museum can be obtained by addressing Mr. Charles R. Buckland, Acting Secretary of the Australian Museum, Sydney, N. S. W. It may be added that no expense will be attached to such donations, the trustees paying all freight charges, etc., on the arrival of goods in Sydney, where they will receive every care and attention.

American Society of Civil Engineers.

We have received, by the courtesy of the secretary, circulars of information respecting the thirteenth annual convention of the American Society of Civil Engineers, to be held at Montreal, Canada, beginning Wednesday, June 15th, 1881. A number of professional papers have already been announced for presentation at the forthcoming meeting, which promises to be one of unusual interest. Members and others desiring to be present, are requested to address for information, transportation and the programme, Mr. John Bogart, Secretary, at the office of the society, 127 East Twenty-third street, New York.

MICA IN SHOE MAKING.—The mineral, mica, is now applied to a new use—that of fashioning it into middle soles to boots and shoes. The invention consists of a sheet of mica, embedded in thin coatings of cement, and placed in the boot or shoe, under and adjacent to the insole, the upper leather of the shoe lapping over its edges, or next under the filling and the outer or bottom sole, and covering the upper space from the toe to the instep.

Miscellaneous and Advertising.

The George Place Machinery Agency, of 121 Chambers street, this city, have always on hand a large line of new and second-hand machinery of every description.

Woodbury, Booth & Pryor, of Rochester, N. Y., are manufacturing a number of sizes of engines and boilers which deserve the attention of manufacturers looking for reliable steam power. This firm invite correspondence, and will cheerfully furnish all desired information.

The fact that over 16,000 Hancock inspirators are in use, demonstrates the great value of this boiler-feeder. It is used by all the principal mills of Lowell, Lawrence, Fall River and Manchester, and by manufacturing establishments generally throughout the country. The manufacturers of this admirable boiler-feeder are the Hancock Inspirator Co., of Boston.

Clark & Co., of 162 and 164 West 27th street, this city, are furnishing a large number of buildings in this city and elsewhere with their self-coiling steel shutters, which possess so many advantages for store fronts as to make them a necessity. They have displaced, to a large extent, the old-style iron shutters, and will no doubt entirely supplant these in the future.

The United States received the largest proportion of awards at the Australian world's fair, as well as the largest percentage of the first order of merits. The list disclosed that New England received over 40 per cent. of the awards, New York 26 per cent, the Middle States 19 per cent, the Western States 6 per cent, and the Southern and Pacific Coast States 3 per cent each.

The fiftieth annual exhibition of the American Institute of the city of New York will open this year September 14th. Heavy machinery will be received as early as August 22d; other goods, September 5th. Parties having novelties which they intend to bring to public notice, should make early application for space, by addressing General Superintendent, New York city.

The Hartford (Conn.) Engineering Co. has just completed the first Hartford high-speed engine for the Billings & Spencer Co., of that city. These engines are building under the Buckeye patents, but with special features introduced by the engineers of this company, Messrs. Church and Barnard. They are now employing 175 men, and are regularly increasing the force.

Owners and managers of large establishments throughout the country will find information of positive value in our 75-page illustrated pamphlet, entitled "Useful Information for Steam Users." It contains data on the care and management of Steam Engines and Boilers and Rules for Engineers and Firemen. Sent for 25c. in postage stamps. The J. N. Mills Publishing Co., 165 Broadway, New York City.

The firm of Bicknell & Comstock, the well-known architectural book publishers, was dissolved May 17th, and the business is now carried on by Mr. William T. Comstock, who has been a member of the firm for the past four years, and who is thoroughly conversant with the business. We understand that Mr. Bicknell will, for a time, retire from active business, as the close confinement to it for the past sixteen years makes it seem judicious for him to take a season of rest. For the present his office address will be the same as heretofore, 194 Broadway.

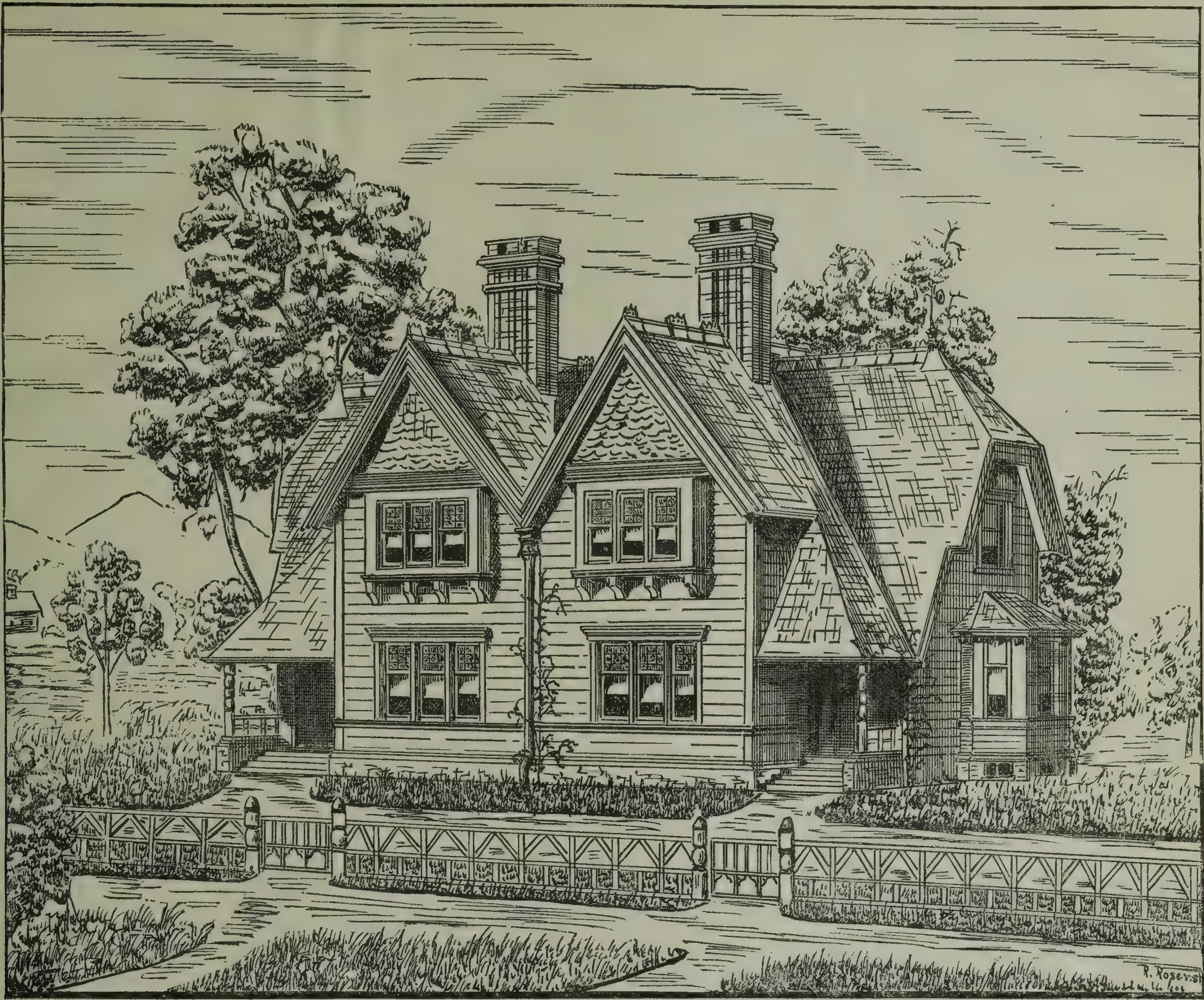
Model Homes.

On the opposite page we present to our readers a picturesque pair of cottages, consisting of six rooms each, designed by R. Rosenstock, architect, 173 East 125th street, New York. The first story of the houses is weather-boarded, and the balance shingled and painted red; the second story front room has corbelled out a bay window, the upper portion of sash being of stained glass. The roof, where expense is not an object, might be slated, but can be shingled and painted to imitate slate.

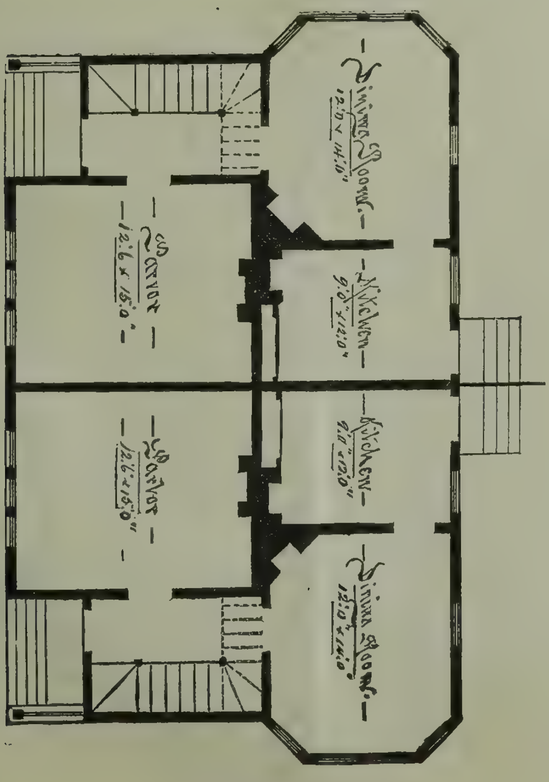
Reference to the plans will show of what size the cottages are. The first floor consists of a good sized parlor, staircase hall, [stairs and hall to be of hard wood,] dining room with octagon bay window attached, [a feature of this room is a large open fireplace] and a good sized kitchen fitted up with range, boiler, sink and china dresser, and if desired wash trays can be put in without much expense. A small verandah is attached to the house in front. To the cellar which is of the full dimensions of the houses, we have access by stairs under the main ones. The upper floor has one large front and two smaller bedrooms; the front room has a bay window projecting eight inches, this room also has a large closet attached. The cottages are intended to be finished in a good and substantial manner, the interior finish to be pine except the hall which is hardwood. The whole throughout to be plastered, the finishing coat being a light gray sand finish, ceilings white with neat stucco cornices in the parlor, dining-room, hall, and two main bedrooms. This, together with the small amount of stained glass, produces an effect seldom to be met with, and comparing favorably with houses of more pretentious design and finish.

These cottages, under favorable conditions and locations, can be built for $2,000.

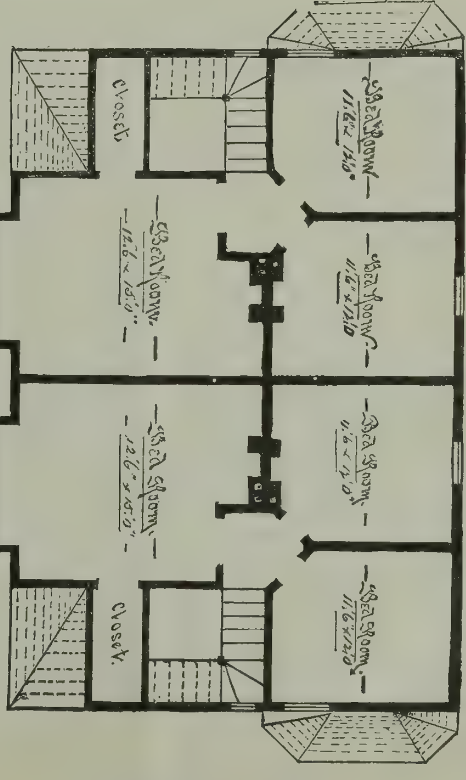
Any further information regarding the above will be cheerfully furnished by the architect, who may be communicated with at the above address.



DESIGN FOR TWIN DWELLINGS, COSTING $2,000.



First-Floor Plan.



Second-Floor Plan.

The Grindstone.

BY A. W. PHELPS.

The process of hanging and razing a grindstone which we describe in the following, is that employed in all large manufactories where the grindstone is used to reduce the hardened steel forging to its proper form and size, preparatory to being polished on the emery wheel. In the manufacture of pocket cutlery every blade is thus brought into shape, and the stones upon which they are ground vary in size according to the size of the work, generally from 16 to 48 inches diameter and 3 to 4 inches face. For these sizes, a steel arbor of 2½ inches diameter is used; the ends or bearings of these rest upon and in grooves cut in the end of maple joist, called "bolsters." Upon these arbors are two iron plates or collars, one of which is shrunk upon the shaft; the loose collar is held firmly against the stone by a large nut. These plates vary in size according to the size of the stone—from 12 to 16 inches. Before placing the shaft through the eye of the stone, these collars are accurately fitted to the stone, so that every part shall bear its own part of the pressure which is necessary to hold the stone in position; and often collars of thin pine are placed between the iron collars and the stone. These fit any inequalities there may be in the stone, and thus lessen its liability to crack.

After the collars are firmly in position, the stone is hung upon its bearings for razing. This is done by means of a small bar of steel drawn to a point and hardened. The process of razing is practically turning, the same as wood is turned in a lathe, except that the razing steel is held below the center of the stone and points downward. The stone is run slowly during razing, so that the steel may cut and not be heated and ground away too rapidly. As often as the steel is ground down, it is turned over to give a fresh cutting edge to the stone. The time occupied in razing a stone is on an average about one hour.

The stone is then ready for use, and the workman stands to one side to watch its motion and see that it is evenly balanced. If not perfectly balanced, the stone will not run smooth, but will jump. To remedy this, a little is chipped from the heavy side.

Oftentimes there are concealed cracks which are not discernable until the stone is razed, and these cracks weaken the stone and render it liable to burst if too great speed is applied, as the centrifugal force overcomes the natural cohesion of the stone. The writer has seen ten or a dozen stones thus burst, throwing large fragments with frightful velocity, and as the grinder sits astride of, and partly over, the stone, it is of the utmost importance that the stone should be perfect and free from cracks, although many are thus used, but their liability to burst at any time is so great that a prudent man does not care to risk himself over them.

In grinding blades for pocket cutlery, the grinder sits on a heavy oak horsing. This mitigates the severity of the blow, which, even with these precautions, is often so great as throw the workman from four to six feet in the air, leaving him liable to fall amid the débris.

The practical grinder has, for keeping his stone true and round, a hack hammer, made of a strip of sheet steel about 12 inches long and 3 broad, and 10 or 11 gauge. This is slightly curved and tempered, and then riveted on a piece of iron with an eye-hole for a handle. This hack is ground on the concave side the same as a carpenter's adze, and in form it somewhat resembles that tool. The grindstone often has soft spots in it, and as these wear away most rapidly, the stone wears out of true. The workman then throws off the belt, allowing the speed to slacken, and with a piece of charcoal held just near enough to mark the high spots, thus ascertains where they are. He then takes the hack and gives the high spots a succession of blows, varying their weight and distance according to the defect to be corrected. These blows are delivered diagonally across the face of the stone from right to left, and *vice versa*, if the defect requires it. These cuts thus lessen the surface of the high parts and cause them to wear as fast as the soft parts. This process of hacking is repeated until the stone is worn out, or, as grinder terms it, "run down."

In addition to the hack, the grinder has at hand pieces of nail-rod cut into about 2-foot lengths, and as often as the face of the stone becomes filled with the fine particles of steel which is abraded from the work, this piece of soft iron is applied across its face. The iron being soft, hugs the stone and loosens the fine particles of steel which fill its face. This process is repeated at short intervals, the length of which can easily be told, as when the steel fills the stone it refuses to cut and the work heats and burns.

The average life of an ordinary stone is about six weeks, depending upon the quality of the stone, the work it has to perform, and the workman. When the large size stones become too small for their work, they are turned out and passed over to the workmen doing a smaller class of work, who take them and "run them down."

New Publications.

Island Life; or, The Phenomena and Causes of Insular Faunas and Floras, including a Revision and Attempted Solution of the Problem of Geological Climates. By Alfred Russel Wallace. New York: Harper & Brothers. 1881.

This admirable work is from the pen of one of the most distinguished of living naturalists, who divides with Darwin the credit of having originated the now famous theory of the variation of species by natural selection, which is popularly given wholly to the latter. Mr. Wallace's fame as a keen, able and original investigator has long been recognized, and his masterly works upon the "Malay Archipelago" and the "Geographical Distribution of Animals," have an enduring value as contributions to science.

The present work may be considered properly as supplementary to the author's previous work on the "Geographical Distribution of Animals," and the facts, principles and conclusions therein presented, respecting the relations of living and extinct faunas, are in the present work confirmed and strengthened by a remarkable array of facts and observations respecting the faunas and floras of numerous islands, the very peculiar and often anomalous character of which cease to be mysterious or surprising when interpreted by this philosophical naturalist. Mr. Wallace compares the existing and extinct faunas and floras of numerous islands,and with the aid of geological and other evidences, traces distinctly the manner in which the organic life peculiar to each now isolated region attained its present character. The thread by which this labyrinth of perplexing facts is safely explored and passed, is the doctrine of evolution, of which the work affords the most convincing confirmation.

The work is amply illustrated by a number of maps and diagrams germane to the subjects discussed, and the publishers have issued it in substantial and attractive style.

A Manual of Rules, Tables and Data for Mechanical Engineers, based on the most recent Investigations, etc. By Daniel Kinnear Clark, M. I. C. E., etc. Second edition. London: Blackie & Son. New York: D. Van Nostrand.

The above is a second and thoroughly revised edition of what is probably the most complete and valuable reference book for the mechanical engineer that has yet appeared. The range of topics it covers embraces every subject with which members of this profession may, by the remotest possibility, be interested; and it will be found of constant service for reference in calculations and estimates relating to the strength of materials and of elementary constructions, labor, heat and its applications, steam and its properties, combustion and fuels, steam boilers and engines, hot-air engines, gas engines, flow of air and of water, air compressors, hydraulic machinery, mill gearing, friction and the resistance of machinery, weights, measures, monies and the equivalent values of different standards in use, specific gravity, etc. The volume also gives tables of logarithms, squares, cubes, square and cube roots, and many other useful mathematical tables. The rules and data embody the results of the most recent investigations, and are presented concisely and with scientific accuracy. The materials for the preparation of the work have been drawn from the best sources of information, and bear evidence of having been largely derived by careful and judicious examination of the proceedings of the leading engineering societies and journals. We know of no work in the language that so completely meets the wants of the mechanical engineer as this one.

The Locomotive. Published by the Hartford Steam Boiler Inspection and Insurance Co. New series. Vol. I. Hartford, Conn. From J. M. Allen, President.

This journal is the official bulletin of the Hartford Steam Boiler Inspection and Insurance Co. It is issued monthly, and contains in every number several thorough and exhaustive articles upon steam boiler explosions that have been brought to the notice of the company's agents and have been made the subject of the careful study of the company's experts. The volumes of the *Locomotive* form together an invaluable work of reference to the steam user and steam engineer, embracing as they do the history of almost every conceivable cause of steam boiler explosion. Each case is made the subject of an intelligent and exhaustive analysis, and the conclusions drawn therefrom respecting the conditions to be met in the construction and management of steam boilers to insure safety, based as they are upon the extensive experience of the company, and tempered by the well known conservatism of its management, are instructive and valuable to an eminent degree. The best evidence that we may offer of the esteem in which we hold the work of the Hartford company, aside from this slight tribute to its excellence, is the fact that we draw regularly from its ample fund of information for the instruction of the readers of the MANUFACTURER AND BUILDER.

The Minerals and Mineral Localities of North Carolina. Being Chapter I. of the Second Volume of the Geology of North Carolina. Raleigh: State Print. 1881. From Dr. F. A. Genth.

This recent publication, which is designated as the joint production of Dr. Genth, and W. C. Kerr, the State Geologist, brings down the subject of the mineralogy of the State of North Carolina so as to embrace everything thus far known. The list of mineral species enumerated as having been found in the State, numbers 178, which is a greater number than has yet been found in any other State. This fact is susceptible of two interpretations, both of which doubtless contribute to the result; first, that the State is unusually rich in minerals; and second, that the survey has been exceedingly fortunate in securing the services of one possessing such rare skill in detecting rare minerals as Dr. Genth. The publication will be found useful to all who are interested in the subject, whether from the economic or purely scientific standpoint. Those in the former category will find full and complete advices respecting the occurrence of gold, silver, copper, iron, zinc, mica and other useful metallic ores and minerals; while the latter will be interested in noting the localities and nature of the occurrence of many of the rarest minerals known to science.

How we Fed the Baby, to make her Healthy and Happy. With Health Hints. By C. E. Page, M.D. 144 pages. New York: Fowler & Wells.

This treatise heralds a new departure in the alimentation of infants, and gives every evidence of conscientious and intelligent study on the part of an author of broad experience, familiar with all the details of the nursery. The central feature of the work represents the infancy of the author's own daughter, whose first months were happily made free from the common inconveniences, not to say horrors, popularly supposed to be unavoidably connected with this period of life. Our author makes plain how infantile diseases may, in great measure, be avoided, and infant life made as free and joyous as that of the most fortunate among the lower animals. This manual will be welcomed by many mothers in all parts of the land, as one of the most important questions with parents is *how* to feed the baby, to promote its health, its growth, and its happiness. The hope of the children must be found in an enlightened motherhood, and every effort in this direction should be welcomed.

The New B. & O. Red-Book. J. G. Pangborn, Compiler. Published by the Baltimore & Ohio Railroad Co. Baltimore, Md. 1880.

This little pamphlet, though originally intended to serve as an advertisement of the Baltimore & Ohio Railroad Co., is at the same time a very thorough and comprehensive political hand-book, and as such will be highly prized by all who are interested in politics. Its statistics embrace the Republican, Democratic and Greenback vote of every Congressional district by counties in every State in the Union in 1878, and the vote in 1880, with the majorities in both years, gains and losses, and the total vote for the same years, with gains and losses.

The work besides this, contains many interesting paragraphs respecting the historical scenes and localities traversed by the great railroad whose interests it advocates; besides much information respecting the business and facilities of the B. & O. Company. Many of these sketches are written in a humorous vein, and all are readable and entertaining.

Barn Plans and Out-Buildings. With 257 illustrations. New York: Orange Judd Company. 1881. Price, $1.50.

This is an octavo of 235 pages, embracing within its moderate space a large number of designs, plans and illustrations for the erection of barns and other out-door buildings necessary for the farm and country house. It contains, besides, much information of a practically useful character respecting the disposition of such buildings, the selection of site, and the like. The practical nature of the work, enhanced as it is by the abundance of its illustrations, adapt it specially to meet the wants of those for whom it has been prepared.

We are pleased to note that Mr. Joshua Rose has become a member of the firm of Egbert P. Watson & Son, publishers of the *Mechanical Engineer*, and is also on the editorial staff of that journal.

The Supreme Court of New York has granted the order to change the name of the corporation of "Scribner & Co." to "The Century Co.," the order to take effect on the 21st of June. The July issues of *Scribner's Monthly* and *St. Nicholas* will have the new corporate imprint.

OTHER PUBLICATIONS RECEIVED.

Statistical Abstract of the United States, 1880. Third number. Finance, Coinage, Commerce, Immigration, Shipping, the

Postal Service, Population, Railroads, Agriculture, Coal and Iron, etc. Prepared under the direction of the Secretary of the Treasury. Washington: Government Print. 1881. From Jos. Nimmo, Jr., Chief of the Bureau of Statistics.

Annual Report of the Commissioners of Fairmount Park, Philadelphia. From Mr. B. W. Pierce.

Third Annual Report of the Bureau of Statistics of Labor and Industries of New Jersey, for the year ending October, 31st, 1880. Somerville, N. J.: State Print. 1880. From the same.

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Preliminary Report of the Department of Agriculture, for the year 1880. Washington: Government Print. 1881. From the Commissioner.

Summary Statement of the Imports and Exports of the United States, for the month ended December 31, 1880, and for the twelve months ended the same, compared with the corresponding periods of 1879. Prepared and published by the United States Bureau of Statistics. [Corrected to February 9, 1881].

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2820) The Sutro Tunnel.—If not asking too much of your space, will you please state in your answers to correspondents something about the Sutro tunnel, where it is, and the object of its construction.—B. R. R., Vandalia, Ill.

(2821) Steam on Street Railways.—Are steam motors in use at present in any of our cities for street railways? and if so, what system has met with most success?—A. T., Denver, Colo.

(2822) Hard and Soft Water.—What is the cause of water being hard or soft, as it is often called? and why is hard water unfit for cleansing with soap?—W. L. W., Reading, Pa.

(2823) Wilson's Magnetic Clothing.—Please give me a little information in "Notes and Queries" in regard to the magnetic clothing advertised by William Wilson, in Broadway, New York. What I wish to know is, if it is good or whether it is a fraud. By so doing you will oblige a number of parties here.—J. S., Cleveland, O.

(2824) Recipe for Chrome Ink.—I will thank you to publish directions for making what is called chrome ink.—S. T. C., Bridgeport, Conn.

(2825) How to Prepare Skeleton Leaves.—Please give me instructions how to prepare skeleton leaves, and oblige.—J. L., Kirkwood, N. J.

(2826) Cutting Glass.—Can you advise me how to cut on curved surfaces of glass, where the diamond cannot well be used?—V. B., York, Pa.

(2827) Mineral Resources of the West.—Which one of our States or Territories is considered to be the richest in mineral wealth?—J. P. L., Augusta, Me.

(2828) Cane and Grape Sugars.—I have read considerable about glucose and grape sugar from corn, but have nowhere met with any information as to what is the real difference between it and our common cane sugar. Are they not really one and the same substance, the difference being simply in the way they are produced?—F. B., Austin, Tex.

(2829) Why Woolen Fabrics Shrink.—Why do woolen goods shrink in washing?—W. L. W., Reading, Pa.

(2830) Cleansing Action of Soaps.—Please explain the cause or nature of the cleansing action of soaps.—W. L. W., Reading, Pa.

(2831) Hydrogen by Electrolysis of Water.—I require a small quantity of hydrogen gas—say 2 cubic feet per day. Having more (water) power than I need, I think I might procure this amount by the electrolysis of water by a current from a magneto-electric machine. If this method is practicable, please let me know the power required to give the 2 cubic feet in 10 hours, and the approximate cost of the magneto-electric machine.—R. B., Halifax, N. S.

(2832) Painting Brick Fronts.—Should you find it within the range of your ability to furnish me a recipe for coloring brick fronts red, you will greatly oblige.—S. B., London, Ont., Canada.

(2833) Paris Exhibition Reports.—Where could I get access to a copy of the Paris Exhibition reports? I refer to the last exhibition, in 1878.—J. P. L., Augusta, Me.

(2834) Lowest Temperature.—I would like to have you state what was the greatest degree of cold ever noticed in this country.—T. R., Battle Creek, Mich.

REPLIES.

(2802) Chemical Nature of Gasolene.—In our reply to J. E. W., in our May issue, the types make us say that the approximate composition of gasolene is, hydrogen, 85 per cent, and carbon, 15 per cent. These values should just be reversed, thus:

Carbon	85 per cent.
Hydrogen	15 "

The error was not noticed until too late for correction in the number in which it appeared.

(2820) The Sutro Tunnel.—The Sutro tunnel, of which this inquirer writes, is a great mining tunnel about 3¾ miles in length, driven through the ridge, or mountain, on which Virginia City (Nevada) stands, from Carson, at the base of the ridge into the deep workings of the celebrated aggregation of silver mines known collectively as the Comstock Mines, from the celebrated lode whose name they bear. The object of the Sutro tunnel, so called in honor of its projector, Adolph Sutro, is to facilitate mining operations in the Comstock mines, which for a long time were prosecuted in the face of serious difficulties. These mines have reached a depth of from 1,000 to 2,500 feet from the surface, and the cost of pumping to keep the works free from water entailed an enormous annual cost—placed as high as two or three million dollars. In addition to this, the high temperature of the deep workings, which reached as high as 120° Fah. added enormously to the cost of mining operations, as it necessitated the changing of the working gangs every half hour or so and the employment of a very large force. These difficulties the Sutro tunnel is designed to obviate by tapping the workings at a depth of about 1,600 feet from the surface, creating, therefore, a new surface for ventilation and drainage at the 1,600-foot level of the mines. At a rough estimate, at the time of the completion of the tunnel, 3,000 tons of waste rock were lifted 2,000 feet daily, and immense quantities of water were pumped into a system of tanks, 200 feet apart, at enormous labor and expense. The Sutro tunnel provides an outlet 1,600 feet below the former surface, through which much of the water from the upper levels drains off naturally, and through which the mining companies, that previously were obliged to pump water the lower levels to the hight of 2,000 feet, can discharge it at an elevation of only 150 to 400 feet. The tunnel intersects the workings of the Savage mine on the Comstock at a depth of 1,640 feet. From the above, our correspondent will observe that this formidable piece of engineering enables the owners of the Comstock mines to reduce their enormous expenses of drainage to a minimum, and to greatly improve the ventilation of the mines so as to enable the men in the lower levels to work in comparative comfort. In addition to these advantages, there are others of considerable commercial importance which it will afford. It was contemplated by the proprietors of the tunnel enterprise, that the tunnel should form the great outlet for the ores of the Comstock, by cars running on rails laid down in the tunnel. These ores were hitherto hoisted to the surface, and thence transported to the mills on the Carson river, a distance of about 20 miles. By the erection of mills at the mouth of the tunnel, at Carson, it was also urged that the advantages afforded by the tunnel would render it profitable to work the low grade ores, which hitherto could not be economically worked, and of which enormous quantities were consequently left in the mines untouched. From the main line of the tunnel, it is contemplated to run out branches to tap all the mines. Work on the tunnel was commenced on October 19th, 1869, and was prosecuted in the face of great difficulties and strenuous opposition of rival interests, to a successful conclusion. It was practically completed on the 8th of July, 1878, when the tunnel heading reached and penetrated the 1,650-foot level of the Savage. Unreasonable as it may appear, the tunnel project met with the most strenuous opposition from the owners and operators of the mines whose best interests it was designed to serve and forward. Since its completion, however, and since the exhaustion of the great "bonanzas" that created such excitement and speculation some years ago, the opposition has been withdrawn, and the Comstock mine owners are said to be acting in harmony with the tunnel owners; and the objects and purposes for which the tunnel was projected will speedily be fully carried out. The best authorities on mining matters agree in acknowledging the great value of the tunnel, and there appears to be no doubt, as one of these expresses it, that in one way or another the Sutro tunnel "will be the salvation of the deep workings on the Comstock lode."

(2821) Steam on Street Railways.—We infer from this question that this correspondent alludes to the use of steam on surface railways—that is, on lines at street grade—otherwise we should simply refer him to the underground steam railways that honeycomb subterranean London, and the elevated steam roads of New York, as conspicuous examples of the use of steam motors for rapid transit in cities. With respect, however, to the substitution of steam motors for horses upon the surface lines of railway, experience has not been satisfactory; and so far as we know at the present writing, such motors have been very generally, if not completely, abandoned where they have been tried. The first experiment of this kind in this country probably, was attempted in New Orleans in the year 1874 or thereabouts, on a suburban road, with the system of Dr. Lamb, which consisted in charging a boiler, partially filled with water, with steam from a stationary boiler located at each of the termini of the route. The motor was given a sufficient charge of steam to provide it with enough stored energy to carry it to the end of the line, where it received a fresh charge sufficient to provide for the return trip. This system may be in use yet for aught we know to the contrary. It could be applied to any form of steam motor. In March, 1877, the Market Street City Passenger Railway, of Philadelphia, put in operation seven steam cars, with the avowed purpose of giving the system a thorough and continuous practical test. These steam cars were of the self-contained type, in which engine and car were combined. The company subsequently experimented with a number of light steam engines, which were coupled to the common street cars. About the same time similar experiments were made in other cities, notably in Baltimore, New Haven, Dubuque, etc. But for various reasons, the use of steam on surface roads seems to have proved a failure, and at present we believe nearly all, if not quite all, the steam cars and motors have been withdrawn. Without regard to the general reasons that have caused the abandonment of steam for street railways, there are special reasons for the impracticability of the steam cars of the self-contained type, inasmuch as such steam cars render the present rolling stock of the railway companies, in which a large amount of capital is invested, practically valueless. Further than this, which is itself a grave objection, there is the additional objection that an accident to either car or engine of one of these self-contained cars lays up the whole apparatus for repairs. The system employing a light detachable engine in these respects has decidedly the advantage of the other, for it permits of the use of the common street cars, to which the engine can be coupled; and should an accident happen, it might lay up an engine or a car, but it would leave one or the other free for use, as the car could be coupled to another engine, or the reverse. The practical failure of the use of steam on surface railways in cities is now generally conceded, and this opinion appears to be justified by the general abandonment of the plan wherever it has been introduced for trial; and if we judge from present indications, the opinion is almost universally entertained among engineers that for the thronged thoroughfares of cities, steam is only admissable as a motive power in connection with elevated or underground (or depressed) railways.

(2822) Hard and Soft Water.—The designation of water as hard or soft has special reference to its cleansing properties and its behavior with soap. River, spring and well waters invariably contain more or less of mineral substances in solution, owing to the solvent action exerted by water on the constituents of the rocks and the soil with which they come in contact. This solvent action is assisted by the carbonic acid which the water absorbs from the atmosphere. The commonest mineral impurities in waters derived from the above sources, are salts of lime and magnesia, principally the former; and they are present either as carbonate (held in solution by the carbonic acid contained in the water) or as sulphate. When either of the above named compounds are present in solution in water in appreciable quantity, it is rendered unfit for cleansing purposes for the reason that they interfere with the action of the soap. If the water be pure (or soft), soap dissolves in it entirely. If it be hard from the presence of the above named impurities, the soap, when added, instead of dissolving, curdles. It is, in fact, decomposed—a new soap being formed, in which the soda or potash of the original soap is displaced by the lime (or magnesia), the latter uniting with the fatty acids with which the soda (or potash) had been combined, and the soda (or potash) uniting with the carbonic acid or sulphuric acid with which the lime (or magnesia) had been combined. The resulting lime soap will not dissolve in water, but may be seen floating on the surface as a kind of greasy scum. It has also the disagreeable peculiarity of adhering to whatever is washed in it, and gives the unpleasant sensation of harshness when the hands are washed. It is necessary, therefore, especially in limestone regions where the spring and river waters are decidedly hard, to remove this quality before they are fit to be used for laundry purposes. Where the hardness is due to the presence of carbonates, this can be done effectually enough for ordinary purposes, by prolonged boiling, which drives off the carbonic acid which holds the carbonate of lime (or magnesia) in solution; and this being removed, the lime precipitates, leaving the water free. The same object may also be accomplished by the addition to the water of a trifling quantity of milk of lime, which unites with the free carbonic acid and is precipitated with the lime originally present as carbonate. Where the hardness is due to sulphates, it cannot be corrected by boiling; but the addition of a small quantity of carbonate of soda (washing soda of the shop) is found to be a good corrective. It throws down the lime as a carbonate, and the excess of soda and sulphate of soda resulting from this action has no injurious effect on the soap or the articles to be cleansed.

(2823) Wilson's Magnetic Clothing.—America has long been the Paradise of quacks, for here, unchecked by the wholesome legal restraints that most European countries throw about the mode and manner of practicing the healing art, they are free to exercise their native ingenuity in beguiling the public by all the seductive methods that the art of modern advertising enables them to bring to bear. The quack nostrum business offers a perennially blooming field of enterprise for hosts of those who have failed in everything else, or who are too lazy to work; and if with these preliminary qualifications they combine a highly elastic conscience, a lively imagination that can be relied on to stand the severest drafts made on it for facts, and the cheek of an army mule, their fortunate possessor will find the business a "bonanza." Wilson's magnetic clothing falls in the category of electric belts, galvanic batteries, magnetic this, that and the other, liver pads and the like, which in almost endless variety are thrust upon public notice in the

advertising columns of the newspapers, whose wonderful virtues are heralded in glowing circulars spread broadcast over the land, and whose praises are proclaimed from every fence, dead wall and rock from Maine to Oregon. From a perusal of William Wilson's circular, which we took the trouble to get at his office in this city, we feel satisfied that he has all the qualifications necessary for success in his chosen field of enterprise. It is a mixture of blatant charlatanry, impudent denunciation of medical science, and shameless puffing of his worthless wares. It abounds in such catch phrases as the following, which we select at random: "Electro-magnetism and health *versus* medicine and death;" "the present system of medicine is scientific murder;" "the Wilsonia will cure you after all other treatment has failed;" "ask your doctor, and die;" "wear the Wilsonia, and live." The whole affair is so completely absurd, ridiculous and impudent, as to be beyond criticism. If any one imagines that magnetism (which is a property capable of being assumed by iron and a few other metals, and cannot be communicated to other bodies) will be of any service to him in any ailment, let him invest a few dollars in a lot of horseshoe magnets and carry one in every pocket, or string them about his neck or elsewhere, or hang them up on his bedpost, where they will do him just as much good. Or, if any one wishes to try the virtues of galvanic electricity, which may really be serviceable in certain kinds of nervous disorders, let him buy a small magneto-electric machine and apply its current to the body under the direction of an intelligent physician. Should he be tempted to try electric belts, magnetic garments, and such like trumpery, let him call to mind the old saying about "a fool and his money," and dismiss the thought.

(2824) Recipe for Chrome Ink.—There are a number of recipes given for making chrome ink, or Runge's ink, as it is sometimes called, from the name of the chemist who first proposed it. Boettger, a well known chemical technologist, gives the following directions: Take of extract of logwood, 15 parts; water, 1,000 parts; crystallized carbonate of sodium (common washing soda), 11 parts; neutral chromate of potassium, 1 part. Dissolve the logwood extract in 900 parts of water, allow it to deposit, heat to boiling, and add the soda. Lastly add, drop by drop, with constant stirring, the chromate of potassium, dissolved in the residual 100 parts of water. The following recipes are recommended by Krüger: (1.) Dissolve 1 pound of extract of logwood in 15 pounds of water, add 1 ounce of alum, and ½ ounce of yellow chromate of potassium. (2.) Boil 10 pounds of best rasped logwood with 100 pounds of water down to 80 pounds. When cold, add 1½ ounces of yellow chromate of potassium, previously dissolved in 5 ounces of water. There are some peculiarities about this ink which are worth noticing for this inquirer's information. The action of chromate of potassium on logwood almost instantly produces a deep blue-black liquid (or dye), suitable for writing purposes. But it is found that on exposure to the air, the liquid frequently decomposes and deposits its coloring matter in the form of large black flakes, leaving the supernatant liquid almost colorless. This peculiar behavior, which doubtless has been observed by all who have made or used this ink, is its great fault, though in other respects it has all the qualities requisite for a good writing fluid. It is cheap, readily prepared, does not corrode steel pens, and makes a permanent stain on paper which can only be removed with great difficulty. To avoid the clotting or gelatinizing of this ink, is the object of the addition of soda or alum in two of the above recipes; but from our own experience they are not always effective. It is probable that the quality of the logwood may have much to do with the rapidity with which clotting occurs, and on this account it will be found best to use logwood chips instead of the extract, which varies greatly in quality. Again, it will be best to make only a little of the ink at a time. By following these directions, the trouble above named will be generally avoided.

(2825) How to Prepare Skeleton Leaves.—A ready method of preparing skeleton leaves is the following: Make a solution of concentrated lye in hot water, in the proportion of about two ounces of lye to a quart of water; or if this is not convenient, prepare the lye by dissolving 4 ounces of common washing soda in a quart of water, adding about 2 ounces of fresh quicklime, boiling for about a quarter of an hour, and when cool decanting the liquid from the sediment. Place the leaves in this solution and allow it to boil for about an hour, or until by trial the pulpy part of one of the leaves allows itself to be readily removed. When this is the case, the leaves are carefully removed one by one, floating on to a sheet of glass, and the pulp is removed by gently tapping or beating with a painter's stiff brush or the like, taking care not to apply a rubbing motion, which would destroy the fibers as well. From time to time the disintegrated pulp should be washed away by allowing a stream of water to flow on the glass. When this operation has been properly performed, nothing of the leaf remains behind but the network of fibers or the skeleton. The next step is to bleach the skeleton leaves, which is easily done by placing them in a shallow dish of water to which a small quantity of chloride of lime has been added (say about a tablespoonful to a quart). In a day or two at most the fibers will be found bleached to a pure white, when they should be removed to a vessel of fresh water for final cleansing, in which they should remain for another day. From this they should be removed, placed between the folds of a soft linen cloth, and allowed to dry. They are then ready to be pressed, curled, or arranged into ornamental designs, according to fancy. Another method of disintegrating the pulp of the leaves which is sometimes followed, is to place them in a dish of water, keeping them beneath the water by the use of a sheet of glass, and exposing them to the sunlight. The disintegration takes place slowly, requiring about two weeks or thereabouts to complete it. The subsequent operations are the same as those above described.

(2826) Cutting Glass.—For cutting or dividing glass tubes of small or moderate diameter, it is generally sufficient to notch the tube at the point where it is to be divided, with the edge of a file, or with a thin plate of hard steel, or with a diamond, after which apply pressure with the two hands, as if to enlarge the notch, or give the tube a smart tap. If the tube is large, it will be found necessary to carry the notch a little more than half way around the tube before attempting to break it, otherwise irregularities in the thickness or strength of the walls of the tube may make the fracture an irregular one. For tubes of very large diameter, employ a fine iron wire stretched in a bow, or, better still, the glass-cutter's wheel, assisted with the use of a little emery and water, with which cut a circular groove around the tube, which can then be divided with ease by applying gentle pressure. A very simple, and, in experienced hands, effective mode of cutting across large circular surfaces of glass, especially useful in the laboratory for removing fractured portions of glass vessels from parts that are still worth preserving, is to apply an iron point (or glass rod) heated to redness, to the glass surface a little in advance of the crack and in the direction towards which the cut is required to be made. The sudden expansion of the glass by the heat causes the crack to spring up to the heated point or rod, which is then advanced slightly, when the crack at once follows. This process is continued until the iron (or glass) has lost its efficiency by cooling. It is reheated, and applied as before. With a little experience at this sort of work, one can carry a crack in a very straight line, or in any direction around a large curved surface of glass. By marking the line to be followed previous to cutting, the eye will be aided in guiding the crack.

(2827) Mineral Resources of the West.—In respect to the value of its mineral products, the State of Pennsylvania stands far in advance of any of the States and Territories composing the Union, the two items of coal and petroleum alone sufficing to give her that preëminence, without taking into consideration her immense iron production from native ores. We have not just at hand the precise figures of value representing the production of these two important materials during the past year, but we are quite within bounds in estimating the annual value of coal (anthracite and bituminous) in Pennsylvania at $60,000,000, and the annual value of petroleum produced in the State at $20,000,000. These together make $80,000,000, and it is probable that $100,000,000 would be nearer the truth. If to this we add the value of the crude iron annually produced in Pennsylvania furnaces, these figures would be swelled by $25,000,000 more. The value of Pennsylvania's production of coal and oil alone exceeds that of the annual yield of the precious metals (gold, silver, copper and lead) of all the States and Territories west of the Missouri river combined. This will appear from the statement that the yield of precious metals in 1880, in all the States and Territories west of the Missouri, was in round numbers $80,000,000. In the production of precious metals, Colorado now takes the lead, so long held by Nevada, with a production last year of $21,284,989. As immense deposits of coal and iron are known to exist in several of the extreme Western States and Territories, it is not unlikely that, at the prodigious rate at which they are developing their resources, the time will come within a generation or two when they will take the lead of the Keystone State in the production of these indispensable materials.

(2828) Cane and Grape Sugars.—There is a radical difference between cane sugar and grape sugar—a chemical difference; so that they are two entirely different substances. They are both classed chemically as carbo-hydrates—that is, substances composed of carbon, hydrogen and oxygen, in which the last two elements are contained in the same proportions as they occur in water; but cane sugar is richer in carbon. The chemical formulæ representing the two substances are respectively, cane sugar, $C_{12}H_{22}O_{11}$; grape sugar, $C_6H_{12}O_6$. Cane sugar can be converted into grape sugar in several ways; but grape sugar cannot be converted into cane sugar. There are other important differences. All sugars are decomposed by the action of ferments, into carbonic acid and alcohol. Grape sugar is very readily affected in this way. Cane sugar behaves similarly, but before undergoing fermentation it is first changed to grape sugar. Cane sugar passes into the solid state much more readily than grape sugar, taking the form of the clear, well defined crystals with which we are all familiar in rock-candy. Grape sugar, on the contrary, solidifies reluctantly, and assumes no regular crystalline form. Cane sugar remains dry and unchanged in the air, while grape sugar becomes damp and mealy from the absorption of atmospheric moisture. Cane sugar also dissolves in water more readily than grape sugar, one pound of water dissolving three pounds of the former, and but two-thirds of a pound of the latter. Finally, cane sugar possesses much greater sweetening properties than grape sugar; two parts of cane sugar in this respect will go as far as five of grape sugar.

(2829) Why Woolen Fabrics Shrink.—The fibers of wool, and certain kinds of hairs, are toothed or jagged at the edges, the teeth (or imbrications) pointing upward—that is, from the root to the point. When subjected, therefore, to compression or friction these fibers, being free to move only in one direction by reason of these asperities of surface, have a great tendency to unite and lock together. This explains the peculiar capability possessed by wool, of felting, and also the shrinking of fabrics of wool. In the latter case, the excessive rubbing to which they are subjected causes a matting or binding together of the ultimate fibers, which causes shrinkage; and this is intensified by changing the goods from hot to cold water, which is usually practiced, as the contraction of the fibers which this causes is itself a felting process. For washing woolen articles, it is recommended to place them in warm water, never in cold; and if changed from one water to another, they should go from hot to hotter. They should be cleansed with as little and as gentle friction as possible. The fibers of cotton and linen are straight and smooth, and possess none of the surface roughnesses that characterize the structure of wool, hence they do not shrink in washing.

(2830) Cleansing Action of Soaps.—To remove stains, dirt, grease and the like, the general principle to be followed is to apply to the same a substance for which they have a stronger affinity than for the surface to which they are attached. The alkalies, soda or potash, are found to possess a very active and energetic solvent power for many substances, and especially for the various forms of impurities which attach themselves to the skin and to textile fabrics or clothing. In their pure or caustic form, however, these alkalies are altogether too powerful, as they would rapidly corrode the skin, or, if applied to textile fabrics, discharge the colors and destroy the tissue. It is necessary, therefore, to temper the active corrosive action of the alkalies, and for this purpose they are united with the weak acids of fat, in which form we know them as soaps; and in this condition they are admirably adapted for cleansing purposes. The basis of the impurities which attach themselves to our clothing and skin is of an oily or greasy nature, derived chiefly from perspiration, though frequently from other and accidental sources, holding or retaining dust and dirt of various kinds. Upon such greasy or oily impurities water alone has no effect; but the alkali of the soap readily takes hold of it, assimilates it, forming with it a compound which readily dissolves in water, and the solid impurities (dust and the like) which it had caused to adhere to the skin or clothing, are then readily removed by gentle friction.

(2831) Hydrogen by Electrolysis of Water.—This question is very similar to that of H. D. E., of Jackson, Cal., answered in our January issue. We reply to him as we did to H. D. E., that the production of hydrogen by the decomposition of water with the electrical current, is considerably more expensive than by the several chemical processes used for the purpose. For a review of these processes we refer R. B. to our January issue, referring specially to answer No. 2747.

(2832) Painting Brick Fronts.—There should be nothing very difficult in making a mixture of mineral pigments which will closely imitate brick-red. The work of renovating brick fronts is usually confined to a few painters who make it a specialty. It requires substantial scaffolding and other special paraphernalia which the general run of painters do not have. Those who undertake this class of work, make something of a secret of their particular mixture; but a little experimenting with small quantities of the common red mineral pigments will enable any intelligent person to strike the proper shade which on drying will most closely approximate to the desired brick color. In the preparation of the pigment for use, the same method would be followed as in the case of any paint for outdoor work. Painters about New York and Philadelphia recommend the use of "Stevens' Brick Red," a preparation in oil, for the purpose, and penciling the joints. A mixture of Venetian red and brick dust in suitable proportions in oil, will probably come very close to the material used by house painters for this purpose.

(2833) Paris Exhibition Reports.—Answering this inquiry, we can inform J. P. L. that so far as we are aware, the reports of the United States Commissioners to the Paris Exhibition of 1878, have not yet been published in complete form. Mr. Morrell's report on iron and steel has been published separately, we believe, by the American Iron and Steel Association (265 South Fourth street, Philadelphia); and perhaps several other special reports have likewise been separately issued, though we only know of the appearance of the one above alluded to. The publication of these reports is in the hands of the Department of State, under the direction of which the reports of the Paris Exhibition of 1867, and the Vienna Exhibition of 1873, were issued in book form; but in both cases several years were allowed to elapse before the volumes were available to the public, so that when they did appear finally—the Paris reports in 1870, and the Vienna reports in 1876—they were of little or no service to manufacturers and others interested in the progress of the useful arts, except as works of reference. At the time of the close of the last Paris Exhibition, it was announced from what appeared to be official sources, that the reports would be ready for distribution about July 1st, 1879. It will probably be a year or two yet before they make their appearance.

(2834) Lowest Temperature.—This question our correspondent had better refer to the Signal Service Bureau at Washington, the officers of which will no doubt cheerfully give it on application. So far as we are aware, we may add, the lowest temperature ever recorded in the United States, was in the month of February, 1866, at the summit of Mount Washington, in the White Mountains, New Hampshire, when the thermometer recorded 59° below zero Fahr.

THE MANUFACTURER AND BUILDER.

Vol. XIII.—No. 7. JULY, 1881. THIRTEENTH YEAR.

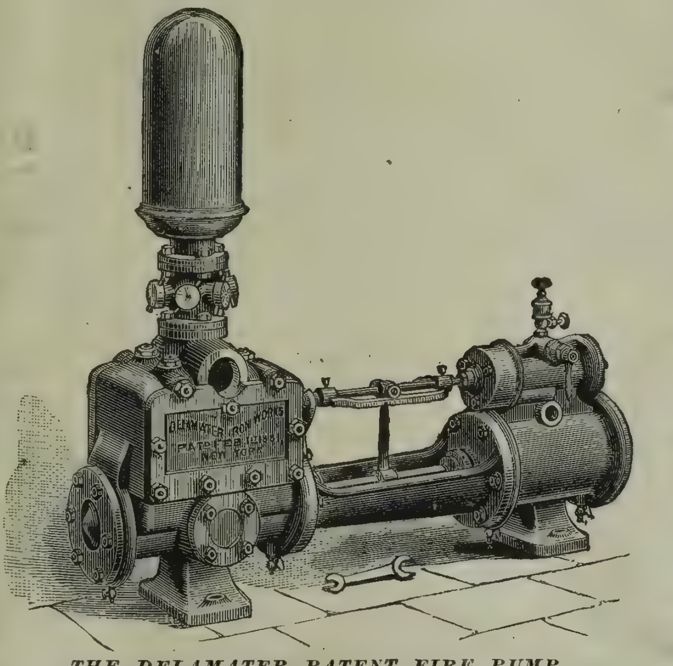
The Delamater Steam Pump.

The manufacture of pumps and pumping machinery, next perhaps only to that of machine tools, has attracted to it the best mechanical talent of the country, and their construction has consequently been brought to a high state of perfection. The progress that has been made in this branch of the mechanic arts, may most reasonably be explained on the ground that the indispensable character of these machines, and the constant and immense demand for them for the divers wants of the household, farm, factory, fire service and water supply to cities and towns, have called into existence great industrial works devoted exclusively to their production; while the sharp competition between rival manufacturers has fostered and seconded the work of improving and perfecting, by making excellence of design, adaptability and eminent merit the imperative conditions of commercial success. With such powerful stimulants it is not to be wondered at that the manufacture of pumps and pumping machinery at present engages the exclusive attention and talents of many of the most widely known manufacturers and most eminent mechanical engineers of the country; and that appliances and machinery of this class in almost infinite variety have been called into existence, adapted for every conceivable want, by the most lavish expenditure of mechanical ingenuity.

To this branch of the mechanic arts, the Delamater Iron Works, one of the leading industrial establishments of this city, have for some years been devoting special attention, and bringing to bear upon their task the highest class of mechanical skill, and with the advantage of possessing unsurpassed facilities for executing work of this kind, they have succeeded in producing a steam pump, which, while fully up, in its general features, to the high standard of excellence established by the representative pump builders of the country, is distinguished by a number of novel and important improvements in details, which materially enhance its value. What these are will appear from the following description of the fire pump built at this establishment, and which embodies many of these special features in its construction. The description has reference to the annexed engraving, which represents the direct-acting steam pump built by the Delamater Iron works.

Starting with the steam or motive end of this pump, the main valve and auxiliary pistons are cast in one piece, and are actuated by live steam, which is admitted to and exhausted from each end of the auxiliary cylinder alternately by a small rotating auxiliary valve, situated in one of the heads of the auxiliary cylinder. This auxiliary valve is rotated by means of a double cam, which is fastened to its stem. The main piston rod has an arm attached to it which projects upward, and on the upper end of which are two small rollers; one of these comes in contact with an inclined surface on the cam each time the main piston reaches the end of its stroke, and rotates the auxiliary valve quietly and without striking a direct blow on any part of the mechanism. This action reverses the condition of steam and exhaust on the auxiliary pistons, causing the main valve to be thrown to the opposite side. There it is arrested by a very ingenious cushioning device which prevents it from striking the heads of the auxiliary cylinder, but allows the full boiler pressure to act upon it to throw it over until it has moved far enough to admit steam to the main cylinder. This arrangement obviates entirely a serious difficulty heretofore experienced in the class of engines which were operated by what is known as "steam-moved valves."

Usually when the pump moves very fast, in consequence of losing the water, or for any other reason, the main valve moves too slowly, and the main piston strikes the cylinder heads before the steam is admitted to reverse its motion. The particular valve arrangement here described is entirely positive in its action, and can always be relied on to admit the steam to the main cylinder before the piston strikes the heads, however fast the pump may be running.



THE DELAMATER PATENT FIRE PUMP.

We come now to the water end of the pump, which is very simple. The valves are arranged in pairs, one suction valve and one discharge valve forming a pair. The discharge valve is directly over the suction valve, and one spindle passes through both, securely holding them and their springs in place. These spindles project above the pump, and when the cap nuts which hold them in place are removed, they are easily drawn out, leaving the valve and spring free to be taken out through the opening in the side, which is covered by the bonnet, as shown in our engraving. These spindles also hold the valve seats in place, and no amount of slamming or water ramming can loosen them while they remain in place.

Respecting generalities, we may add that these pumps are made in the best manner and of the best materials. The seat of the auxiliary valve, and also the piston rod, are made of phosphor-bronze. The auxiliary pistons are provided with steel piston springs. All the parts are made on the interchangeable plan, and any piece of a pump will fit upon any other pump of the same size.

The above description will give a very clear idea of the general and special features of the Delamater steam pump. The establishment manufactures steam pumping machinery for every variety of service, from the smallest to the largest water works pumping engines. The establishment guarantees its machinery, and invites correspondence.

The Delamater Iron Works are situated at the foot of 13th street, North River, and the warerooms are at 10 Cortlandt street, New York.

Silk Culture in America.

The culture of silk, which is a comparatively new enterprise in this country, has lately been steadily growing in popular interest, and promises soon to become a very important as well as a very lucrative vocation. Its growing popularity is largely due to the efforts of the Women's Silk Culture Association of the United States, whose headquarters are in Philadelphia. This vigorous organization is constantly at work spreading information relating to the development and care of silk worms, the handling of cocoons, and the preparation of the silk for market.

One of the latest circulars issued by this organization, gives full and explicit details for the management of a cocoonery, and shows that large returns may be secured for the time and labor which this industry demands. It appears that, at present, there is more profit in raising eggs and cocoons for the markets of France and Italy than in making reeled silk. The female moth lays 300 to 400 eggs, and it is estimated that an ounce will be produced by every 200 to 250 moths. The worms from an ounce of eggs will yield from 100 to 125 pounds of cocoons, worth from \$1.25 to \$2 per pound; or will produce from 100 to 120 ounces of eggs, worth from \$3 to \$5 per ounce. But this requires much care in raising and preserving, and more detailed instruction than can be given here, and, moreover, a special selection of eggs to start with.

There is a good market in this country for reeled silk, at Paterson, N. J., and elsewhere where silk manufactories flourish; and of cocoons and eggs the Women's Silk Culture Association will take all that are sent them at the regular market rates.

Persons wishing to engage in this industry, will be able to receive all needful information, material, books of instruction and the like, from the society, which, in the brief period of its existence, has done wonders in creating a widespread public interest in silk culture. The correspondence of this admirable pioneer organization extends to nearly every State and Territory of the country; hundreds of persons are now engaged in raising silk, and thousands of mulberry trees have been sent out. The interest in the subject which the society has created, is growing rapidly, and promises to be permanent. One of the plans of the society for directing public attention to its work of domesticating this

valuable industry, which has just been announced, is the holding of a Silk Exhibition in Philadelphia during the latter part of next October, at which it is expected everything relating to the culture and manufacture of silk will be fully represented. A number of prominent silk manufacturers, it is said, have cordially entered into the plan of the society, and have promised their coöperation.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 7. THIRTEENTH YEAR.

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(Illustrated articles are indicated by an asterisk (*).

Experimental Steam Boiler Explosions.

Experiment in the practical reproduction of natural phenomena, under varying conditions, as nearly as possible similating those which surround their occurrence, is peculiarly the scientific method of acquiring knowledge of nature's mysteries. With its aid the boundries of our knowledge are extended safely and surely; and it affords the only certain method of testing the correctness of conflicting theories and hypotheses. With so trustworthy a resource at hand as this, it is somewhat surprising that it has not been called upon to clear up the mysterious and doubtful points respecting the causes of certain steam boiler explosions. This subject is one of the greatest possible practical importance, and on this account it would be natural to suppose that no phase of the problem had escaped thorough investigation and elucidation. Nevertheless, there is no other subject of anything like equal practical importance concerning which there is as much varied theorizing and speculation as there is concerning this one.

It is true that several well directed efforts have been made in this country to investigate the subject of steam boiler explosions experimentally, with the view of determining with accuracy the conditions under which steam boilers explode, and of testing the correctness of numerous theories and hypotheses, more or less reasonable, that have been advanced to account for special and peculiar cases of explosion; but much still remains to be done. The earliest systematic experiments of this kind, and probably the most useful and valuable, were made about the year 1835, under the auspices of the Franklin Institute of Pennsylvania, by request of the Treasury Department of the United States. The facts ascertained in these investigations are still quoted as authoritative by writers and investigators on this subject. But these experiments by no means exhausted the subject, and as they were made chiefly on a small scale, and with apparatus of special construction, it has been urged that some of the conclusions announced were not entirely freed from doubt, on the ground that the apparatus employed could not perfectly reproduce the conditions that occur in practice. To meet this objection, other experimental investigations on a large scale, with boilers taken from actual service, have been projected and carried out, partly by private parties and partly by the government. Much was expected from the commission in charge of the last named experiments, but lack of the proper pecuniary resources, of proper authorization to make the investigations exhaustive, and other causes, combined to limit the usefulness of the work. A commission of scientific engineers, clothed with ample powers and provided with ample means to investigate the whole subject of steam boiler explosions exhaustively, is very much needed.

A Questionable Verdict.

On the first of June just past, a boiler explosion, attended with the loss of several lives, took place at the works of Messrs. Gaffney & Co., Philadelphia, to which the subsequent investigation and verdict of a coroner's jury lend special interest. The boiler that exploded was one of three of cylindrical form, used in the works, each 30 feet long and 36 inches diameter, provided with flat cast-iron heads of the usual construction, and placed side by side. The boiler that exploded was the newest of the three, and supposed to be the best. All three had recently been inspected and pronounced to be safe, but, singularly enough, the one that would naturally be thought to be the strongest, exploded, while the other two remained in their places uninjured.

The verdict of the jury was to the effect that the explosion was due to the improper use of cast iron in the flat head of the boiler; and they coupled this finding with a verdict of censure upon the Hartford Steam Boiler Inspection and Insurance Company for the incompetence and negligence of its agents who inspected and certified to the safety of this boiler; and they urgently recommended the municipal authorities to take measures to prevent the recurrence of such disasters. The coupling of a verdict of censure in such a case as this, would not be considered a matter of much weight or worthy of serious consideration in a technical journal, were the jury composed, as coroner's juries usually are, of men who are well up in the mysteries of shoemaking, baking, or anything else but steam boilers. But this one happened to be an exceptionally good jury, for we find upon it the names of a half dozen well-known machinists and engineers of our neighbor city, and on this account the verdict will be apt to be more carefully pondered over than is usual with such utterances.

In looking for the facts and reasons upon which the verdict of the jury was based, aside from the portion reflecting upon the Hartford company, we are forced to the opinion that the examination which they made at the inquest was altogether too superficial to warrant their positive utterance as to the cause of this explosion. There were three boilers side by side in the establishment, all with flat cast-iron heads, and otherwise substantially identical; there are hundreds of steam boilers in service in all parts of the country, with flat cast-iron heads, and there are no facts that we are cognizant of, in the record of such boilers in the past and present, to warrant the sweeping denunciation of this form of construction that the jury make in their verdict. So far, in fact, from condemning this particular form of construction, there appears to be at least reasonable grounds for the belief that the jury erred greatly in assigning the explosion to the cause they name, which, so far as their examination and report show to the contrary, might with much greater show of probability be ascribed to causes entirely independent of the particular portion of the construction which they condemn. It has, indeed, been asserted on excellent authority that "it seems pretty certain that the explosion was due to an over-pressure of steam, caused perhaps by inoperative safety valves and closing of the steam stop valves leading to the other boilers and to the dye works." Concerning the condition of these stop valves, it is not disputed that most of them were found to be closed when examined after the explosion.

Where circumstances having so important a bearing upon the case as those just noted, are altogether ignored, the value of the verdict rendered is very seriously impaired, if not indeed rendered entirely worthless. This state of affairs is made all the more surprising from the fact that it would be difficult to make up a jury better qualified than this particular one to make such an examination searching and thorough.

The sweeping censure passed upon the agents of the Hartford Steam Boiler Inspection and Insurance Co. we believe to be utterly undeserved. The high standing of the company, attained by years of faithful and laborious devotion to its work, and the competency and reliability of its agents, are too well known and admitted by hosts of steam users throughout the country to be swept aside by one questionable verdict.

Abating the Nuisance of the Wires.

Score one for Chicago. The news has reached us that the authorities of that city have taken the right step towards abating the nuisance of telegraph and telephone wires, and we have little doubt but that the course of Chicago will be followed sooner or later by all our prominent cities. We refer to the report widely circulated by the newspapers that the municipal authorities of Chicago have given notice to the telegraph and telephone companies, that after a certain date no wires will be allowed on posts or on house-tops in the city, but that all wires must thereafter be conveyed under ground.

This action of the Chicago authorities will meet with hearty approval on all sides, and the residents of that city are to be congratulated on having officials who manifest the proper intelligence and firmness in deal-

ing with this important question. Some of our readers may think, from our frequent references to this question, that we exaggerate its importance; on the contrary, we are convinced that the most constant and vigorous treatment that we could give it would fail to adequately picture the extent and magnitude of the nuisance with which we are threatened in the immediate future.

It should be borne in mind that, in addition to the constant additions to the lines of the great companies, to accommodate the natural growth of their business, and the rapid multiplication of private wires, our cities are threatened with an immense increase of overhead wires by the telephone companies, which last method of communication is growing immensely in popularity, and bids fair very soon to obtain almost universal extension. In nearly all of our large cities the telephone companies are asking for special rights and privileges to encumber the streets, and in many cases receiving them. If, now, in addition to the enormous aggregation of the overhead wire nuisance threatened from this quarter, we contemplate the possibility of the general introduction of electric lighting, our cities will be fairly enclosed within a bewildering network of wires, and the unsightly poles that now encumber our streets multiplied a hundredfold.

The time for decisive action in this matter has come. The longer the telegraph and telephone companies and private individuals are permitted to encumber the streets and house tops, and multiply their posts and wires, the greater will be the plausibility of their argument that it would be a great hardship to compel them to remove them at enormous expense. The growth of the system of telephonic communication bids fair to far outrival, in time, the telegraph in the extent of its obstruction of our streets, and steps should be taken now to prevent it before the evil is consummated and our present nuisance enormously aggravated.

We have pointed out very clearly in our former editorial references to this subject, that the assertion that underground telegraphy is impracticable, is unworthy of credence, and so manifestly false as to subject those who advance it to the suspicion of being influenced by motives the reverse of laudable. The fiat that has gone forth from Chicago, we hail as the beginning of the end of the post and wire nuisance in American cities; and we hope to see it speedily repeated by the authorities of all our cities. Underground telegraphy must come here as it has in European cities, and the only question at present, is whether the authorities of our cities will have the good sense to do what Chicago has done, now while the nuisance, though bad enough, is still endurable and manageable, or whether they will wait and allow it to grow until it becomes intolerable.

Manufactures as an Element of National Greatness.

It is instructive to consider how rapidly we are emancipating ourselves from dependence upon European countries for our supplies of numberless manufactured products. Astonishing as has been, and is, the development of the agricultural and mineral resources of the United States, the growth of our manufactures in value and variety is equally remarkable, and is a most cheering augury for the permanent greatness and prosperity of this country. A country may be ever so fertile, and ever so rich in mineral treasures, but so long as the industrial forces of its people are confined to the production of food and the raw materials to furnish foreign nations the means with which to keep their mills, factories and workshops busily employed, that country will continue to be dependent, and despite its fertility and richness, will never rise above a subordinate place among the nations of the world. We need go no further than Mexico, or the South American States, to find abundant proofs of this assertion. It is only necessary for the intelligent man to look about him to observe that the powerful nations of the world are those which have most completely developed their manufacturing industries. The whims and antipathies of monarchs and rulers that once played so important a part in the histories of nations have ceased to make history. The world has long ago become tired of that sort of nonsense. The elements and conditions that affect the industrial development of countries, are those which to-day shape the policy of governments.

The rapid development of our manufacturing industries, which is now progressing at an unparalleled rate, should therefore be regarded with peculiar pride and gratification by every patriotic American, since every such expansion of the higher industrial activities of our people is a permanent addition to the strength of the nation and an additional safeguard to the permanency of our political institutions.

The rate at which our manufactures are being developed, gives promise that at no very distant day they may rank in value and importance with those of the leading European nations. But there is one fact connected with the future industrial development of this country which is of immense advantage to us now, and will be of vastly greater advantage to us in the future, namely, that our country, by reason of its extent and the great variety of its soil and climate, renders practicable the cultivation or production of almost every raw material that forms the basis of an important manufacturing industry. The leading nations of Europe are now dependent upon distant quarters of the globe, and to some extent upon the United States, not only for food staples, but for many of the raw materials for their manufactures. The advantage of possessing both of these elements of natural wealth side by side, the ability to produce the crude materials and the means of converting them into manufactured products of low and high degree, cannot be too highly estimated in forecasting the future growth of the republic. They are great and exceptional, and in time will combine to elevate our country to a condition of absolute independence of the rest of the world.

The commercial prosperity of nations likewise is obviously very closely related to the magnitude and variety of their manufactures. A glance at the subjoined tabular statement of imports and exports will make this connection manifest:

	Imports.	Exports.
ENGLAND.		
Raw materials.	$784,236,980	$117,727,030
Food...................	885,068,960	33,217,320
Manufactures..........	174,894,340	854,093,190
FRANCE.		
Raw materials....... }	425,320,200	250,838,600
Food................ }	364,721,800	
Manufactures..........	84,183,600	347,098,200
UNITED STATES		
Raw materials..........	182,057,686	310,900,287
Food...................	215,219,419	439,996,838
Manufactures..........	247,065,378	73,081,365

In the item of manufactures, it will be noticed, the United States still import far more than they export, while the total figures of our exportation of manufactured products are still far below those of England and France.

Storing Electricity.

One of the most interesting of recent scientific achievements, is the reported success of M. Faure's method of storing electrical energy in an accumulator or storage battery of peculiar construction, so perfectly that, according to the statement of Sir William Thomson, the eminent English physicist, by actual measurement, no appreciable loss was incurred in transmitting a box of stored electrical energy from Paris to Glasgow. Many efforts have been made to store up electrical energy in quantity, so that it might be drawn upon at pleasure as required without necessitating the constant use of batteries or generators, as is now the case; but until the report of M. Faure's success, the methods devised had not given much promise of possessing a practical value.

The results of Sir William Thomson's experimental trials with the box of stored electrical energy transmitted to him from Paris to Glasgow, are of a very different nature, and their complete success in demonstrating that electrical energy can be stored like compressed air, transported from place to place, kept for a considerable time without serious waste of energy, and used from time to time as it is required, represents a great advance in our practical mastery of this remarkable agent, and immensely simplifies the problem of electric lighting by removing one of its most serious difficulties. The results of this notable experiment were deemed of sufficient importance to be transmitted to this country by cable by the agents of the associated press. We are not yet advised of the nature of the "Faure accumulator" with which these remarkable results are made possible, but these will doubtless be made public in due time. Meantime, we give our readers the letter of Sir William Thomson, in which he gives the facts and conclusions on which we have commented. In a letter addressed to the London *Times*, he says:

"The million 'foot-pounds' kept in the box during the seventy-two hours' journey from Paris to Glasgow was no exaggeration. One of the four cells, after being discharged, was re-charged again by its laboratory battery, and was then left to itself absolutely undisturbed for ten days. After that, it yielded me 260,000 'foot-pounds,' or a little more than a quarter of a million. This not only confirms M. Reynier's measurements, but it seems further to show that the waste of stored energy by time is not great, and that for days and weeks, at all events, it may not be of practical moment. I have already ascertained enough regarding its qualities to make it quite certain that it solves the problem of storing electric energy in a manner and on a scale useful for many important practical applications. It has already had in this country one interesting application of the smallest in respect to dynamical energy used, but not of the smallest in respect to beneficence, of all that may be expected of it. A few days ago, my colleague, Prof. George Buchanan, carried away from my laboratory one of the lead cells, weighing about 18 pounds, in his carriage, and by it ignited the thick platinum wire of a galvanic écraseur and bloodlessly removed a tumor from the tongue of a young boy in about a minute. The operation would have occupied over ten minutes if it had been performed by the ordinary chain écraseur, as it must have been had not the Faure cell been available, because, under the circumstances, the surgical electrician, with his paraphernalia of voltaic battery to be set up beforehand, would not have been practically admissable. The largest useful application is waiting just now for the Faure battery, and I hope that a very minimum time will be allowed to pass until it is to do for electric light what a water cistern in a house does for an inconstant water supply. A little battery of seven boxes suffices to give the incandescence in the Swan or Edison lights to the extent of one hundred candles for six hours without any perceptible diminution of brilliancy. Thus, instead of needing a gas engine or steam engine to be kept at work as long as the light is wanted, with the liability of the light failing at any moment through the slipping of the belt or any other breakdown or stoppage of the machinery, and instead of the wasteful inactivity during the hours of the day or night when the light is not needed, the engine may be kept going all day and stopped at night, or it may be kept going day and night, which undoubtedly will be the most economical plan when the electric light comes in general enough use. Another very important application of the accumulator is for the electric lighting of steamships. A dynamo-electric machine of very moderate magnitude and expense, driven by a belt from a drum on the main shaft, working through the twenty-four hours, will keep a Faure accumulator full, and thus, notwithstanding the irregularities of the speed of the engine at sea, or the occasional stoppages, the supply of electricity will always be ready to feed the Swan or Edison lamps in the engine-rooms and cabins, or arc lights for the mast-head, and red and green side lamps, with more certainty and regularity than have yet been achieved in the gas supply for any house on *terra firma*."

Water-Supply Fixtures and Machinery.

We illustrate and describe herewith several special appliances manufactured by the well-known firm of Julius Jonson & Co., Metropolitan Iron Works, foot of East 118th street and Harlem River, New York. This establishment is devoted especially to the manufacture of machinery and appliances for water works, in which direction the exceptionally valuable experience of the head of the firm, in the Croton Aqueduct Department of this city, for a number of years has proved of great advantage, in enabling the firm to meet every practical requirement for a perfect water service in their machinery and fixtures.

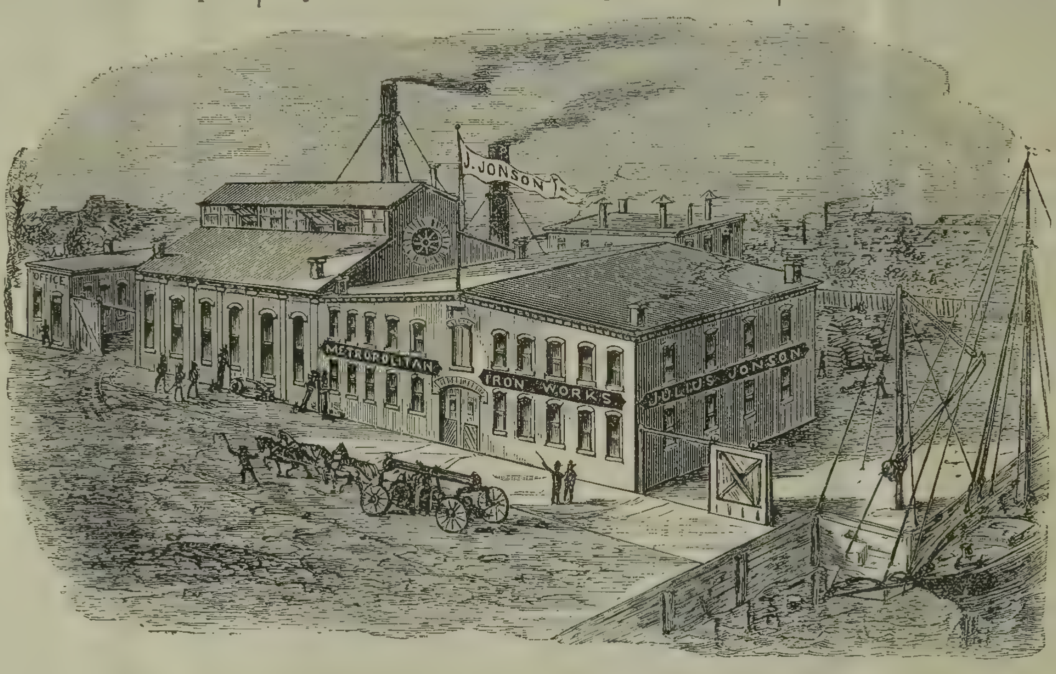


Fig. 1.—Metropolitan Iron Works, foot of East 118th Street and Harlem River, New York.

The firm manufacture fire hydrants, gates, and all the special castings—curves, bends, Y-pieces, etc., in use at water works. Several of these specialties which have come very generally into use, we illustrate in the accompanying engravings, Figs. 3 and 4 being respectively external and sectional views of an improved fire hydrant, and Fig. 2 a view of a gate valve of standard pattern. The manufacturers invite special attention to their fire hydrants, the design of which in several important features is protected by letters-patent. These hydrants are guaranteed to be non-freezing, being provided with simple and reliable waste valves, by which the water remaining in the stock or barrel of the hydrant is drained absolutely down to the valve.

The following brief description will explain the essential features of this apparatus, reference being made to the sectional cut, Fig. 4:

The main valve is made of a number of leather disks, which open downward against the pressure of water in the main, being operated by the lever at the top of the hydrant. Where it passes through the valve, the valve stem is hollow, and extends downward, communicating with a passage way through the brass waste valve and guide seen in the cut. The operation is as follows: When the main valve is closed, the water in the barrel above it drains out through the hollow stem and waste valve, leaving the barrel above free from water down to the upper edge of the valve. When the main valve is opened, the openings in the stem pass the packings in the waste valve and prevent any leakage of water from the main through it. Should any stoppage occur in the waste valve, the same may be blown out by simply opening the main valve about half an inch and keeping the nozzle caps on. The main features for which the makers claim superiority over other waste valves in use for this purpose, are, simplicity, positiveness, the drawing of water from the barrel down to the valve, and the means of clearing it from any sediment. We are informed that hundreds of these hydrants are now in use in New York and other cities, and that during the past exceptionally cold winter not one has been frozen.

These hydrants are built with special tools, and are interchangeable in all their parts. Each one is fitted up and carefully tested before leaving the works, with as much care and attention as is bestowed upon engines and work of that class. The valves and stop-cocks receive the same attention. They are made of all sizes from 2½ to 48 inches in diameter; all facings, etc., are of brass, and they are finished and tested in the most careful manner. Our illustration, Fig. 2, shows one of these appliances, which requires no detailed description.

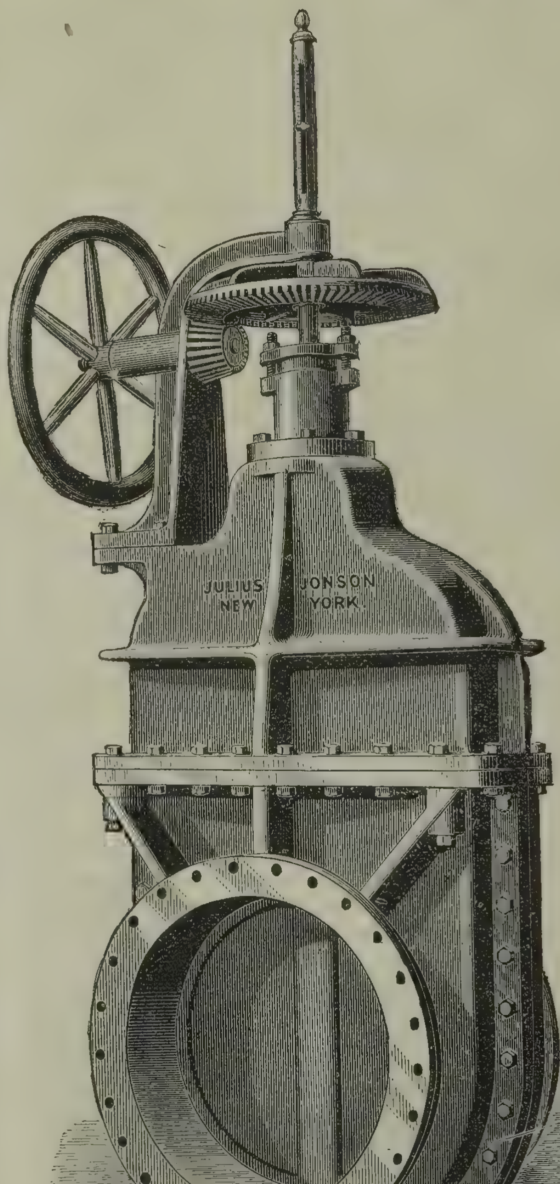


Fig. 2.—Julius Jonson & Co.'s Gate Valve.

In addition to the manufacture of water works fixtures to which this firm devotes special attention, they are prepared likewise to execute all kinds of work, both as brass and iron founders and machinists. Fig. 1 represents a perspective view of the works, which occupy a frontage of 300 feet on 118th street, running through to 119th. They have the convenience of a dock, which affords every facility for shipping. The works comprise a machine-shop, with a frontage of 100 feet on 118th street. This structure is of brick, two stories high, well lighted, and provided with every improved appliance for handling work rapidly and cheaply. The foundry is a square building, 90 feet on each side, with appliances for handling pieces up to 20 tons weight. In addition to these departments, there are also a blacksmith shop, 40 by 25 feet; the pattern and flask shops and lofts, a building 80 by 20 feet; a large room for cleaning castings, 25 by 100 feet; while the offices and store-rooms cover about the same space. The works at present are engaged on an iron screen tower for the water works of the city of Newark, N. J., and have besides a large number of orders on hand for their hydrants, water gates, etc., from all parts of the country, some of them even going to Mexico and the South America republics. The firm, in addition to the above specialties, are largely engaged in the manufacture of miscellaneous iron work for buildings, etc., and are likewise the exclusive manufacturers of the Griffith & Wundrum patent safety boiler.

Concerning this last named specialty, we add a few explanatory remarks, and may supplement the same in one of our later numbers with a fuller description and illustration. The boiler in question is of the sectional pattern, for which type we have repeatedly expressed our preferences on the score of excellent steaming capacity, economy of fuel, and safety against destructive explosions. The Griffith & Wundrum boiler has been manufactured for a number of years, and has been quite largely introduced, and from all that we have learned concerning the record which it has made in practice, it has the reputation of being an admirable steam generator, lacking in no important or desirable element that steam users could demand.

The construction of this boiler will be readily understood by our mechanical readers from the following account of its distinguishing features: It consists substantially of a series of lap-welded tubes inclined at an angle, and connected at front and back ends by vertical connections, to a drum supported horizontally above them. The water level is maintained at about the center of the drum, thus insuring that the tubes shall always be filled with water. The disposition and inclination of the tubes likewise insures a rapid circulation and free escape of steam. The steam makes its entrance into the drum from the front or highest end of the tubes, which

is also subjected to the greatest amount of heat from the fire; while the water descends from the back or cooler end, through the back connection, and enters into the tubes at the lower end. Through this system, a thorough circulation and rapid and uniform genera-

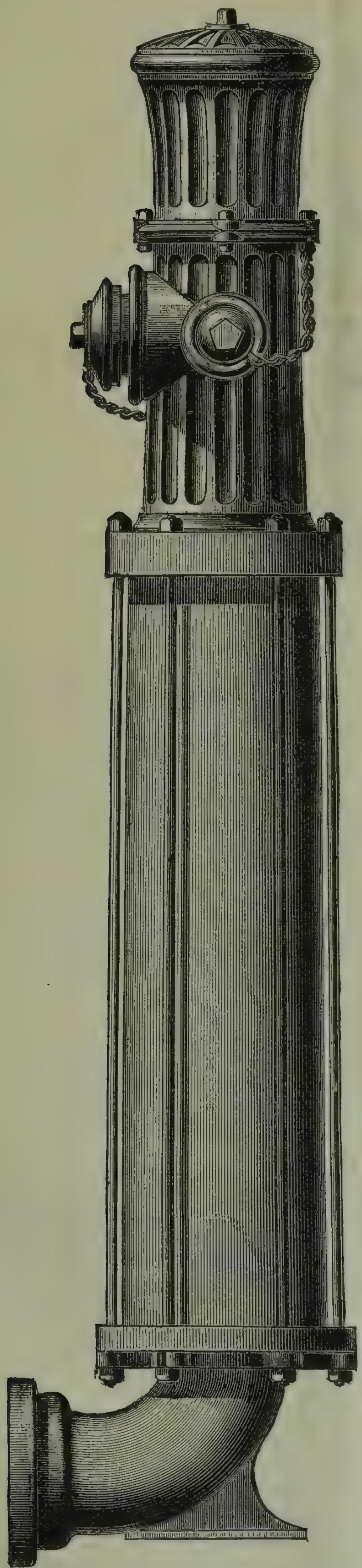


Fig. 3.—Julius Jonson & Co.'s Improved Fire Hydrant—Exterior View.

tion of steam is maintained, and all parts of the generator are maintained at an equable temperature. The combustion chamber is so arranged as to insure that combustion shall be as perfect as possible. The generator has a large water surface, a provision that insures the making of dry steam and reduces the possibility of foaming to a minimum; while the large and free passages between the different sections, insures the practical equality of pressure throughout the whole system, and renders easy the uniform maintenance of the whole line. The several elements of the system are constructed with a great excess of strength beyond the usual requirements of practice, a feature which practically obviates any danger from straining at the joints between the different members from unequal expansion, which has generally been looked upon as one of the prime difficulties with the sectional generator. The generator of course possesses the important feature of immunity from liability to disastrous explosion, which is one of the most valuable qualities of the sectional type of construction. These boilers are made of the best materials and in the best manner, and are provided by the manufacturers with the best and most improved appliances and fixtures.

As above remarked, we may be able to present our readers with an illustration and a more detailed description of this steam generator in one of our early forthcoming numbers.

We predict for the establishment of Messrs. Jonson & Co. a foremost rank among the iron works of this city, to which it will certainly attain if knowledge of business, energy and liberal means are factors of success.

Lumber from Straw.

We referred in one of our late issues to the invention of a process for producing solid masses or blocks of any form and size from straw, which had been patented by a Western inventor. The *Northwestern Lumberman* of recent date, reports the receipt of a sample of such lumber, made from straw, from the inventor, Mr. S. W. Hamilton, of Lawrence, Kan.

The inventor of this curious product claims that he can manufacture lumber in any desired length, from 12 feet upward, and to 32 inches wide, at a cost competing with the better or finishing grades of pine. Our contemporary says of the sample sent to it, that it will hold a nail as well as wood, that it is equally susceptible to a high painting finish, and can be polished to as high a degree as is desirable. It is made water-proof, and our neighbor thinks there is no reason why it should not be as durable, or more so, than pine, or even oak, while its adaptability is evidently as great for roofing purposes as for the fine work of a dwelling.

The new material appears to be capable of being worked under the plane and other tools of the carpenter, and has the special advantage of being free from knots and not liable to shrinking, swelling, warping and splitting. The material, judged from the sample, is reported to resemble hardwood in appearance, being about as dark as oak, but more dense in texture, and with a specific gravity one-fifth greater than thoroughly seasoned black walnut. Its tensile strength is reported to be about double that of wood of the same thickness.

From the above description, the new material would seem to be possessed of all the desirable properties of wood, and to be capable of taking its place for constructive purposes with advantage. The practical success of the new product, taking it for granted that its qualities have not been overestimated or misstated, will depend very largely upon its cost.

The manufacture of lumber from straw is a very novel and interesting innovation, of which we take special pleasure in making record.

Coal Discoveries in Arizona.

Recent accounts in the Western newspapers confirm the reports lately made of the discovery of extensive and valuable deposits of coal in Arizona. The precise location of the newly discovered fields is near Saddle Mountain, twenty miles northeast of the junction of the Gila and San Pedro rivers, on the upper waters of Deer Creek.

The deposits were traced by outcroppings, through a large portion of a valley some twelve miles in length, and in one ravine or cañon, where the water had cut a wash-out of some twenty feet in depth, the prospecting party found the black walls of coal on both sides, reaching from top to bottom, while the floor of the wash was still in the deposit. The news of the discovery

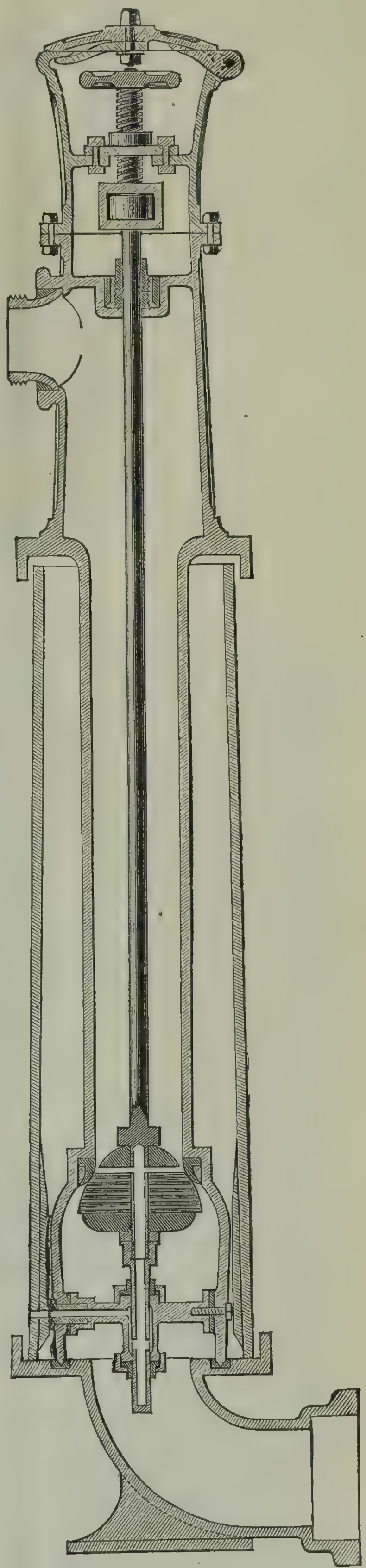


Fig. 4.—Julius Jonson & Co.'s Improved Fire Hydrant—Sectional View.

attracted many prospecting parties to the region, and a number of claims have already been located.

The coal is represented to be a coking coal, of excellent quality, free from deleterious impurities, and well adapted for the needs of that country. The location is not far from that of extensive copper smelting works, in connection with which they promise to become immediately valuable.

Wales' Feed-Water Heater and Purifier.

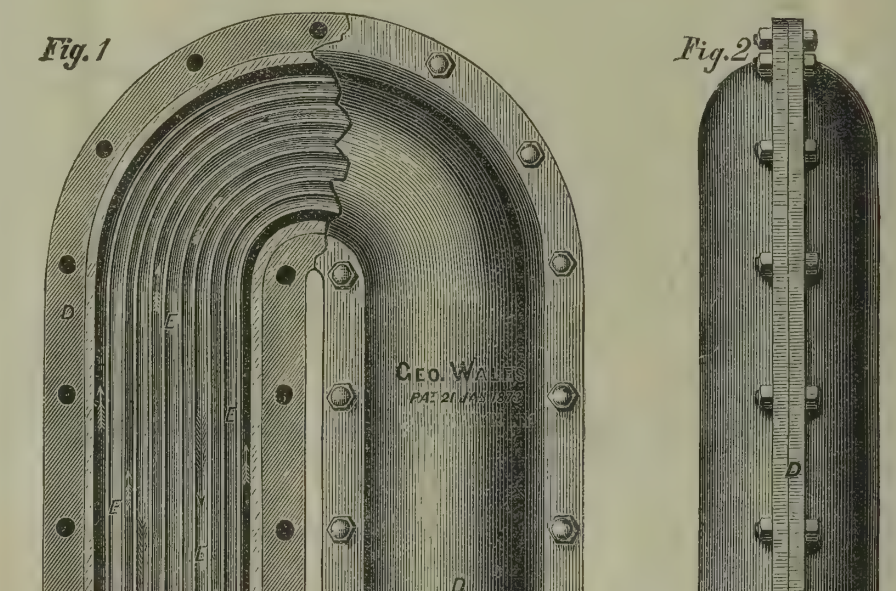
Our illustration represents a very compact and useful form of feed-water heater, manufactured by J. A. Crouthers, of 115 Liberty street, this city. It is designed to utilize waste or exhaust steam in heating water for steam boilers. The apparatus is, likewise, well adapted for heating water for dyeing vats in woolen mills, print works, hotels, and in all situations where large supplies of pure heated water are required. The water emerges from the apparatus almost at the temperature of steam. By simply making the water connections larger, and removing the water with greater rapidity, the apparatus may be employed as a surface condenser, and can easily be adapted to marine engines.

The U shape of the tubes and of the outer casing, besides giving the apparatus great compactness, provides effectively against injurious action through differential expansion.

The construction of the heater will be understood by reference to the engravings shown herewith, in connection with the following description. Figs. 1 and 2 are respectively front and side views of the apparatus, a portion of the outer covering being removed in Fig. 1 to permit of a sight of the interior. Fig. 3 is a cross section exhibiting the position of the copper or brass tubes, to be hereafter described, and Fig. 4 shows the manner in which the tubes are inserted. Referring to these, A is the steam chamber; B is the condensed-water chamber, with injector for carrying away condensation; C is the inlet pipe for water; D is the U-shaped case; E, the tubes for steam; F, outlet pipe for water; G, nozzle for the entrance of steam; and H, nozzle for the escape of the steam. The heater consists of an inverted U-shaped casing, made in two parts, for the purpose of ready access to the tubes to remove sediment or to repair breakage. The two parts are joined by bolts and flange, as shown in Fig. 2. This casing contains a number of tubes of the same form, and greater in area, of the exhaust pipes of the engine, and sufficient not to interfere with the exhaust, though at the same time affording sufficient surface to heat the water effectively and quickly. The heads carrying the tubes are bolted in between the lower flange of the U-shaped casing and the top flange of the connecting steam chambers A and B. The water enters by the inlet pipe C, Figs. 1 and 2, at the lower part of the case, and directly above the tube heads over the chamber B. It passes slowly between the tubes E E and the walls of the case, escaping by the outlet pipe F near the base and above the chamber A. The steam is admitted into the chamber A through the nozzle G, Fig. 1, passing into and through the tubes E in the direction of the arrows, escaping into the chamber B at the opposite side, when it escapes through nozzle H, Figs. 1 and 2. By this arrangement the water enters at the coolest part, grows gradually hotter as it passes among the steam tubes, and escapes where the steam enters, or at the hottest part of the case.

It will appear from this that the flow of the steam and water are in opposite directions, an artifice which insures a very thorough interchange of heat between them. By modifying the connections of the apparatus, the action of the machine may be reversed by passing the steam through the body of the chamber and the water through the tubes, should this be deemed desirable. The velocity of the discharge of the heated water is governed by the relation subsisting between the area of the outlet F and the area of the spaces between the tubes. As the area of these spaces is much greater than that of the outlet, the outflow is very slow, and the water is consequently retained in its passage through the chamber sufficiently long to become thoroughly heated before its exit therefrom.

The practical advantages of appliances of this class have been repeatedly pointed out in our columns, and need not therefore be repeated here. This particular apparatus is distinguished by the simplicity of its construction, its compactness, and the thoroughness of its provisions for obtaining the maximum of heating effect from the steam employed. In addition we may state that the apparatus can be readily taken apart for cleaning or repairs. The apparatus has come into very general use, and has made an excellent record in practice.



WALES' PATENT FEED-WATER HEATER AND PURIFIER.

Cutting Down Forests.

Public attention has been frequently called to the rapid destruction of the pine forests of the Northwest by the operations of the lumbermen. During the winter logging season recently closed, it appears that enough trees have been felled in the States of Michigan, Wisconsin and Minnesota to produce the enormous amount of 6,279,950,000 feet of lumber. The summer logging work, it is estimated, will add 1,150,000,000 feet more, so that the total product of the year will aggregate 7,429,950,000 feet.

The census agents sent to survey the pineries of the Northwest, have just reported that the whole quantity of pine timber standing in the three great lumber States above mentioned, is only 81,650,000,000 feet, so that if the rate of destruction now going on is kept up, only twelve years will elapse before the supply is exhausted.

The Maine pineries are already almost worked out, and most of the still extensive lumbering operations of that State are now confined to the spruce timber. Last summer a vessel loaded with Michigan pine arrived at Bangor, the metropolis of Maine lumber regions. The event created considerable sensation, and was thought to indicate that the pine industry of the State is practically a thing of the past. Fortunately, however, the danger of a lumber famine is not as serious as might seem from a hasty glance at the future.

The extensive pineries of southern Georgia, covering hundreds of square miles, have scarcely been touched yet. Southern Alabama and northern Florida also contain a large amount of pine timber. Texas, which formerly drew its lumber supply from far distant States, is now, since the opening of the International, the Great Northern, the New Orleans and Texas, and other railroads through the eastern part of her vast domain, finding within her own borders an ample stock for her own needs.

Some allowance must be made, too for the growth of the young trees in the Northwestern pineries from which the larger timber has been removed and where the soil is too poor for the land to be converted into farms.

Industrial Exhibition in Montreal.

The intelligence comes through the French Consul-General for Canada, that a complete exhibition of French industry is to be made in Montreal during the month of September next, in connection with the provincial exhibition. The Paris Board of Trade is displaying great anxiety to develop commercial relations between France and Canada, and every branch of French industry will be represented at the exhibition, and is now making its preparations for the collective exhibit. A steamer will be furnished by the French government to convey the deputation and the goods to Canada, and the exhibition will be open for a month.

"Common Sense" Drying Apparatus.

We present herewith an illustration and a more detailed description of Fuller's "Common Sense" drying apparatus, to which we referred in our last issue. Fig. 1 is a perspective view of the apparatus and of the drying chamber, with a portion of the wall removed to show the interior. The apparatus is adapted for drying lumber, grain, chemicals, wool, and generally any materials requiring to be dried or seasoned.

Fig. 1 shows its application to the seasoning of lumber, a description of which will fully explain the principles of its operation. As applied to this purpose, Mr. Fuller's apparatus includes the following elements: A drying chamber, or several chambers, of sufficient size to hold one or more car-loads of lumber, so constructed that they can be tightly closed and thoroughly warmed or heated. The heat is furnished by a series of steam pipes placed upon a tight flooring at the bottom of the room. The peculiar feature of the apparatus, however, is the provision that is made for the admission of dry air into the chamber, and the removal of the same from the room, laden with moisture from the lumber. The principle involved in this operation is new, so far as its practical application to this use is concerned. It consists of an eduction pipe, through which the heated and moisture-laden air is drawn from the chamber after having circulated through it. The air is drawn from the dry-room by means of an exhaust fan, which delivers it through a connecting pipe into a cylindrical chamber, called the condenser. This condenser is kept at a low temperature by means of a coil in which cold water is kept constantly circulating while the apparatus is in operation. The moist and hot air drawn from the dry-room, on entering the condenser, is instantly chilled, by reason of which a large portion of its moisture is at once precipitated and collects at the bottom of the cylinder, from which it runs out through a drip pipe. From the condenser, the air, now desiccated, is forced down the descending pipe and into the dry-room again through an induction pipe at the bottom of the chamber, which admits it through one or several openings. The desiccated air being rapidly heated by the heat radiated from the steam pipes, its capacity for moisture is thereby greatly increased, and the moisture is more freely extracted from the lumber in its circulation through the apartment. It is again drawn out through the eduction pipe at the top of the chamber, deposits its charge of moisture in the cooled condenser, and enters again at the bottom to repeat the operation again and again.

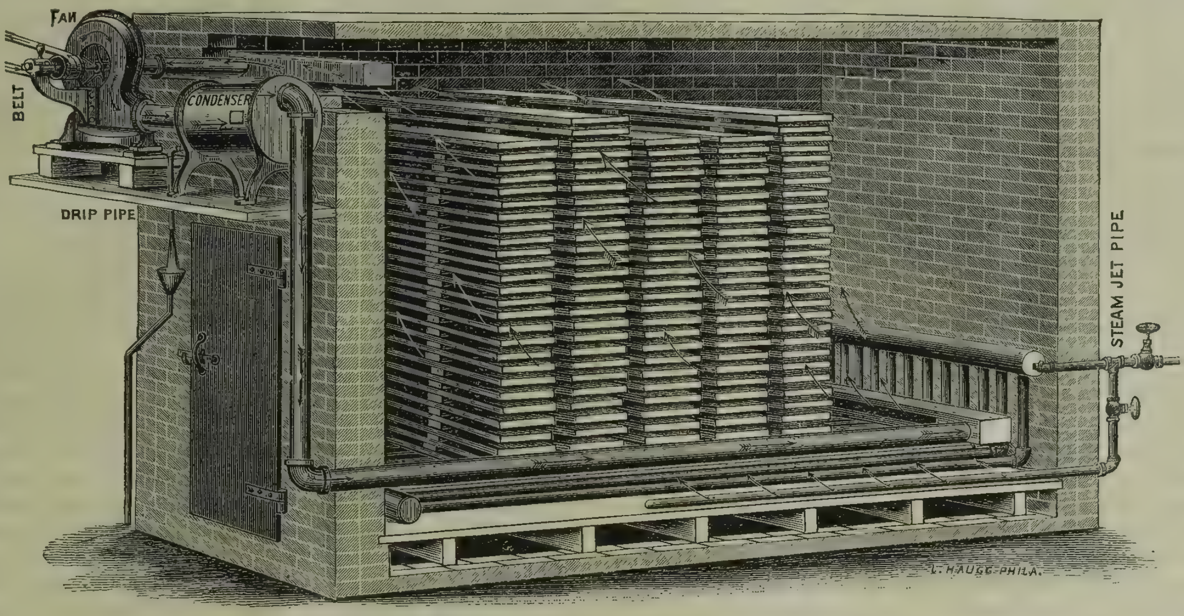


Fig. 1.—"COMMON SENSE" DRYING APPARATUS.

In order that the seasoning process may be perfect, and at the same time greatly advanced, a live steam jet pipe is admitted into each chamber. This properly prepares the lumber, by placing it in a sweating condition at the first, and it also facilitates the escape of the natural moisture of the wood through the open pores. This steam jet is admitted from time to time thereafter, as the condition of the lumber requires, and gradually removed by the power of the fan. It prevents all that warping and checking, which, by the common process of drying by hot air, proves so unsatisfactory. The desiccation of the air before its admission into the drying chamber, permits of the use of a very moderate heat, which is a great advantage in this and similar operations. This fact is obvious, as the outside air drawn into the chamber without being previously dried, will require to be much more highly heated in order to possess the same capacity for abstracting moisture from other bodies, that it possesses when previously dried. This fact is of great importance in preventing the injury of the lumber when drying.

By means of this process, the operation of seasoning lumber of every description is carried on with uniformly excellent results, far superior to those obtained by the old process of using hot air. Of this fact we are assured, not only by the uniform testimony of manufacturers using it, but from personal observation. Fig. 1 shows the details of the "Common Sense" drying apparatus too clearly to require special reference.

The difference between the results obtained by the old and the improved drying process here described, is well shown in Figs. 2 and 3, which are printed from sections taken directly

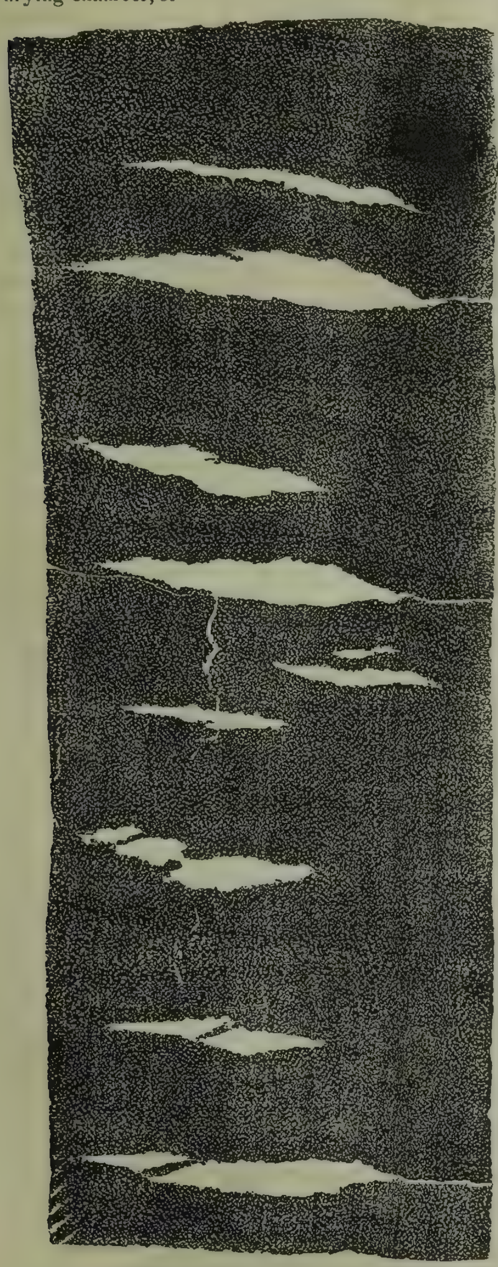


Fig. 2.—End Section of Lumber, Dried by the Ordinary Process. Badly Checked.

Fig. 3.—End Section of Lumber, Dried with "Common Sense" Apparatus.

from the end of dried lumber. Fig. 2 is a section of a walnut plant dried in an ordinary ventilated dry-house, and, not having been thoroughly seasoned out of doors, is checked badly; time in dry-house, three months. Fig. 3 is made from a section of walnut plank, dried without warp or check, by the "Common Sense" drying apparatus; time in dry-house, nine days.

The apparatus is manufactured by the St. Albans Manufacturing Co., of St. Albans, Vt., who will furnish all needful particulars on application.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

H. J. Hardenbergh is now completing plans for an apartment house, 100 feet square, at the corner of University place and Eleventh street.

Henry Weiler, the builder, is about to erect a large flat at No. 12 St. Mark's place, 26x90 feet, and five stories high. It will have a brown stone front, and is to cost $22,000. Wm. Jose is the architect.

On the east side, between Sackett and Degraw streets, a two-story brick church, to cost $100,000, is to be erected by the congregation of St. Agnes Roman Catholic Church; architect, T. F. Houghton.

Ex-Governor Morgan has bought a plot of ground in Tenth avenue, between 103d and 104th streets, 201 feet by 327 feet 6 inches by 196 feet 8 inches, for the Home for Indigent Females. The total cost is to be $77,500.

A variety theater, capable of seating 3,000 persons, is soon to be built on the west side of Eighth avenue, between Twenty-fifth and Twenty-sixth streets. It will be T shaped, and be known as Harry Miner's Eighth Avenue Theater.

Office buildings Nos. 46 and 48 Broadway are being torn down to make place for a new building which will have a brick front in place of iron as originally designed by the architects, Messrs. D. & J. Jardine. Mr. Alexander Brown, Jr. is the builder.

On the north side of Eightieth street, 175 feet east of Second avenue, Francis McQuade is going to build three brown stone apartment houses, 25x60 feet with extension 10x14 feet, and four stories in hight, to cost $45,000. A. B. Ogden is the architect.

The building furore shows no signs of abatement. All kinds of houses are being projected. The greatest opera house known to this continent is one, while immense buildings for offices, stores, warehouses, as well as great apartment flats, are under way.

On the northwest corner of Ninetieth street and Third avenue, W. H. Browning is going to build three brown stone stores and flats from designs of A. B. Ogden. Two will be 28x60 feet, and one 20x60 feet. They will be four stories high, and will cost $42,000.

Work will commence at once on the new Harlem church at the corner of Madison avenue and One Hundred and Twenty-fourth street. It will be 75x105 feet, two stories high and constructed of granite. In connection with the church a chapel will be built. The estimated cost is $60,000.

R. S. Anderson has prepared plans for remodeling the building owned by W. G. Langdon, at 39 Broadway, into offices. It is 26 feet 6 inches on Broadway, running through 200 feet to Church street, and has a frontage of 32 feet on that street. It is to be heated by steam and have steam elevators. The first and second floors will be of iron, and the windows of plate glass; cost, $30,000.

H. J. Dudley has prepared plans for four French flats, to be put up on the north side of Fortieth street, about 200 feet west of Seventh avenue. They will be five stories high, with basement, built of brown stone, and cost $20,000 each. The dimensions are 25x82 feet.

Contracts have just been awarded for the erection of an eight-story office building at Nos. 44 and 45 Broadway, and running through to New street. It will be 40x175 feet, and built of brick, terra-cotta and granite. It is to cost $110,000. Col. V. K. Stevenson is the owner. D. & J. Jardine are the architects.

A bill has passed both houses and gone to the Governor, incorporating a company known as the New York Building Company, with power to purchase real estate, erect buildings, or contract for their construction, and all the necessary powers for that purpose. The corporators named in the bill who are to exercise the powers of the building company, are Frank Jenkins, John Tracy, Thomas A. McIntyre, Arthur Macy, John W. McLean, Henry W. Curtis, Richard M. Martin and Murthe Thompson. The capital stock is fixed at $500,000, with power to increase it to $3,000,000.

Carl Pfeifer has drawn plans for an apartment house to be erected by a joint stock company, composed of eight shareholders, on the northwest corner of Fifty-second street and Madison avenue. It will be 76x95 feet, and eight stories high, exclusive of basement, under-cellar, and attic. The basement and first story are stone-faced, and the remaining stories are built of brick. The cost of the structure is $150,000. Mr. Pfeifer is about to form two other companies which have grown out of this one as a nucleus. He is also preparing plans for another apartment house to be built on the southeast corner of Fifty-third street and Madison avenue.

On the site of the old Theater Comique, Messrs. Livingston and De Forest are going to erect a six-story building with basement. It will take in lots Nos. 512, 514 and 516 Broadway, and extend through to Nos. 56 and 66 Crosby street. On Broadway will be a frontage of 75 feet, and 151 feet on Crosby street. The depth of it is 195 feet. The structure will be over 100 feet high from street level to cornice. The depth of the foundation walls is to be 24 feet, and their thickness three feet at the base. At the bottom the upper wall will be 2 feet 4 inches thick, and 20 inches at the top or roof. The front is to be constructed of brick and iron, trimmed with Wyoming blue stone, while the roof will be brick, with galvanized iron cornices. A large court in the center will light the interior of the building. It will be heated by steam. Work will commence as soon as the foundations of the old building are removed. This mammoth structure will cost in the vicinity of $300,000. It is expected that it will be ready for occupancy in the autumn of 1882. It will probably be occupied by wholesale stores.

The property and the plot comprising the whole front on Seventh avenue, and running back 400 feet on Fifty-eighth and Fifty-ninth streets, has now passed into the hands of Jose F. De Navarro, who intends to erect on this property, said to be highest south of the Park, six of the most magnificent apartment houses in the world. On the plot last mentioned, four of these houses will be erected, being divided by two streets, the one running from east to west will be 25 feet in width, while that running north and south will be 12½ feet. At the junction of these streets there will be an extensive courtyard, containing four beautiful fountains and a great variety of the most rare and costly plants and flowers. Between these houses and the Hawthorne Apartment House, there will be another street, 12½ feet wide, running through from Fifty-eighth to Fifty-ninth street, and at the point where it intersects with the street running east and west, there will also be an extensive fountain and tropical plants, etc. On the plot between the Hawthorne Apartment House and Charlier's Institute, two more apartment houses are to be erected. These houses are all to be erected of iron, brick and stone, and to be thoroughly fire-proof. The courtyard, streets and houses are all to be lighted by electricity. The apartments are to be 50 and 100 feet front. The location selected for this magnificent improvement is the finest in the city, opposite Central Park, surrounded by five different lines of horse cars leading direct to all the ferries, unequalled drainage and sewerage, the grade from Sixth to Seventh avenues being 25 feet wide, all combine to make this the most healthy as well as fashionable locality for wealthy citizens who desire to live in regal apartments. The total cost of the six buildings including the ground will reach $5,000,000.

Miscellaneous.

Philip J. Ritter is about to erect, in Philadelphia, on the south side of Dauphin street, east of Frankford avenue, a manufacturing building, 40x70 feet 6 inches, three stories and basement.

Bids are being received for the erection of the Armory of the Third Regiment, N. G. P., at Twelfth and Reed streets, Philadelphia. The building is to be 142x200 feet; plan by Geo. E. Bland, C. E.

Rhodes, Curry & Co., Amherst, Mass., intend to rebuild their factory at that place on a larger scale. The new building will be three stories, 40x84 feet, with brick engine house, roofed with corrugated iron.

Mr. Mason, of Gloversville, N. Y., is erecting a frame three-story and French-roof hotel on the Boulevard, Coney Island, between the New York & Brighton Beach Railroad Company's depot and the Roman Catholic church.

The corner-stone of the new Christ's Episcopal Church at Portsmouth, N. H., was laid June 24. The edifice is to be of stone and after the old English style of architecture, and is built through the munificence of the late George M. March; cost, about $100,000.

Alexander Hudnut, of soda water fame, has erected a magnificent mansion in the Queen Anne style at Orange, N. J., and the architects, Lamb & Wheeler, have excelled themselves in this magnificent example of the now most popular style of architecture. It is stated that the cost of this palatial house was $130,000.

John Wharton is building a six-story apartment house on Market near Lawrence street, Newark, N. J. It will be 72x72 feet, containing twelve suites of rooms and three stores. It is to be constructed of brick, with stone trimmings, and is to have two elevators. Paul Botticher is the architect. The cost will be $40,000.

Contracts have just been let for a dwelling for W. S. Kimball, Rochester, N. Y.; house to be 70x90 feet; first story of dark stone, with finish of Albion stone; second story frame, with plaster panels stamped; roof and gables of tile and red slate; house to have organ in hall; James G. Cutter, architect; cost to be about $60,000.

L. J. O'Connor has prepared plans for a building to be known as the St. Lucy's Retreat, to be erected at Rockaway Beach. It will be 205x100 feet, and two stories high with basement and attic. The frame will be filled in with fire-proof material between the studs. It will have brick retaining walls. It is to be for the use of newsboys, and is to cost $55,000.

The corner-stone of the new building of the Philadelphia Protestant-Episcopal Divinity School, at Philadelphia, was laid on Tuesday, June 21. The school will stand on Woodland avenue, between Fiftieth and Fifty-first streets. The building will be 194 feet in length, with an extreme depth of 80 feet over the wings. Accommodations will be provided for forty-nine students; cost, $50,000.

At a meeting of the Executive Committee of the Industrial Exposition and Musical Festival Association of Baltimore, Md., held at the City Hall on the 21st of June, two plans were submitted, one to erect a permanent structure in the center of the city, costing about $500,000; the other, to lease a lot on the outskirts of the city, and to erect on it a temporary structure, in which to hold an exhibition in the fall, with a view of afterwards erecting a permanent building in the center of the city.

In Chicago plans have recently been completed by Burling & Whitehouse for the largest block of buildings now in course of construction in that city. It will be 128x220 feet, and six stories high. The building is the joint enterprise of Marshall Field, E. H. Sheldon and Mrs. McCagg. It will be erected on the north side of Adams street, between Fifth avenue and Franklin street. The probable cost will be $185,000. The remainder of the frontage of this block on Adams street will be occupied by two buildings to be erected by the Chicago, Burlington & Quincy Railroad Company, and Conrad Furst.

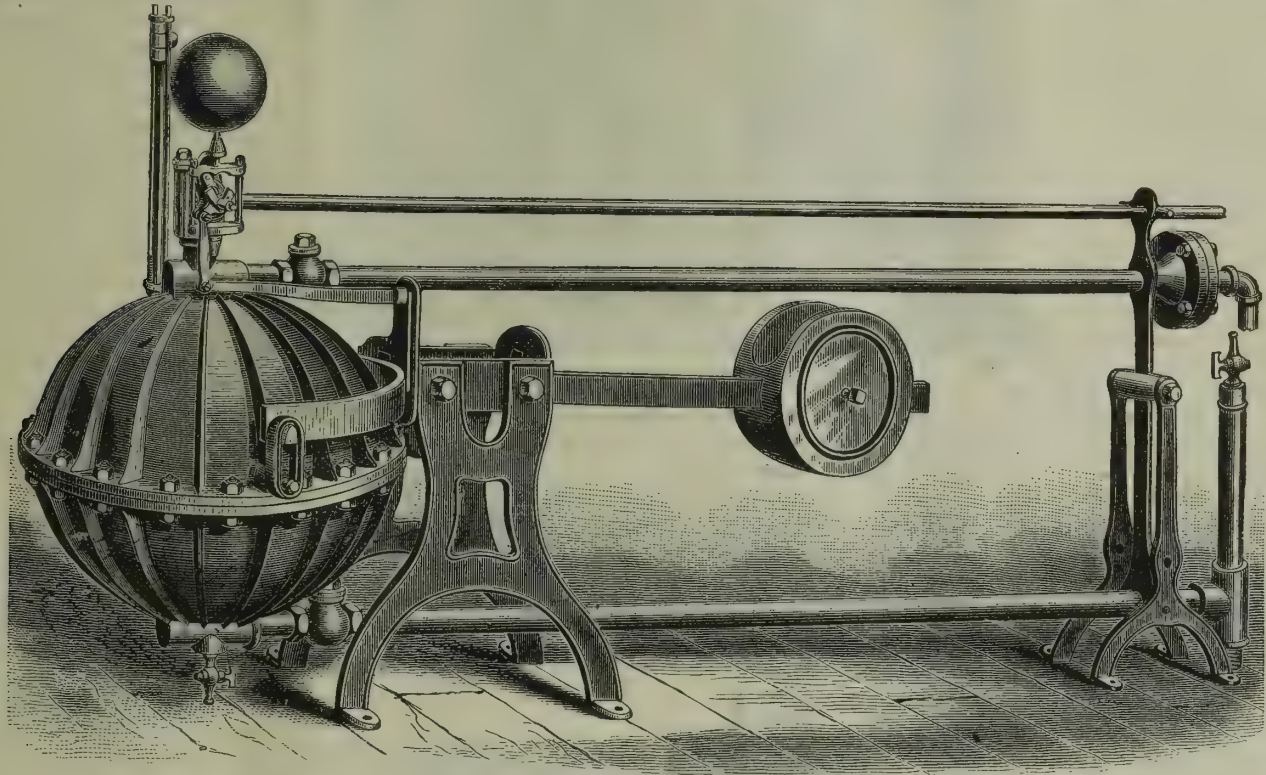
An Improved Steam Trap.

We illustrate and describe herewith a form of steam trap manufactured by the Albany Steam Trap Co., of Albany, N. Y., which possesses a number of meritorious features. Those who are familiar with the use of steam for heating purposes, need hardly be reminded of the desirability of effecting the removal of the water of condensation from the pipes as rapidly as it collects, to insure proper circulation, and to avoid the hammering which is often so disagreeable an accompaniment of steam heating appliances. This removal of condensed water should be accomplished, not only regularly as rapidly as it forms, but without such consumption of steam as to trench seriously upon the boiler pressure. These requirements are difficult to meet in practice, and in spite of much ingenuity that has been expended in the invention of steam traps, many of these devices are only partly satisfactory.

The trap shown in the accompanying illustration is claimed to meet the requirements of the case above named very completely. It is entirely automatic in its action, effects the regular and constant removal of the water as it condenses from the steam in the heating coils, without noticeably affecting the boiler pressure, and returns the water to the boiler at a temperature a few degrees from the boiling point. This work it accomplishes automatically, without the intermediation of pumps or other special mechanical devices, and equally well whether the heating coils are above or below the water-level of the boiler. The regularity and certainty of the action of this trap renders it possible to control to a very perfect degree the heat supply to a building, by the regulation of the valve admitting steam to the heating coils, since it very effectively guards against the "backing up" of the water of condensation in the pipes.

The body of the trap is formed of two hemispherical pieces of cast iron, ribbed for the purpose of giving it adequate strength to withstand the steam pressure, and bolted firmly together at the flange joint. Communicating with the top of the trap is a receiving pipe, through which the water of condensation, collected in a drip-tank (into which all the coils discharge), is forced into the trap by the steam pressure in the coils. From the base of the trap proceeds a discharge pipe, its opening controlled by a valve, which communicates with the water space of the boiler. Above the receiving pipe, is a smaller pipe proceeding from the steam space of the boiler, which at proper intervals admits steam at boiler pressure into the trap, the movement of the latter controlling valves at top and bottom for the admission of steam and the discharge of the accumulated water into the boiler simultaneously.

The action of the trap is secured by supporting it upon a bracket by means of the lever and heavy weight, as shown in the engraving. When the pipes have been properly arranged and connected with the trap (the latter placed about 30 inches above the water level of the boiler), the large weight is adjusted on the lever arm in such a position, that, whether the pipes be hot or cold, the trap will always rise sharp and quick when empty. The air is first removed from the system, either by opening the coils to the atmosphere until the steam has expelled it, or through the automatic air valve placed on top of the trap. In the latter case, the air will escape through this valve, forced along by the drip-water entering the trap. When the trap shall have accumulated sufficient water to overcome the balancing weight, it will fall and open the boiler pressure or equalizing valve, admitting steam into the trap, which, expanding the tube, closes the air valve and prevents the further escape of steam or air. When the trap has emptied itself, it will rise and close the boiler pressure or equalizing valve. If any air still remains in the pipes, the tube of the air valve will soon become contracted and allow the air to escape, and the trap will be ready to receive anew the drip water.



THE ALBANY STEAM TRAP.

From the foregoing description and an inspection of the cut, the construction and action of this ingenious contrivance will be fully understood. As remarked at the outset, the trap takes the water direct from the heating coils, whether the same be located above or below the boiler, and returns it to the boiler at a temperature not far removed from the boiling point, thereby not only rendering effective service as a trap for removing the water from the coils, but effecting a material saving in fuel, and keeping the boiler supplied with pure water.

The manufacturers mention the following special cases where their trap can be advantageously and economically applied, namely: To return to the boiler the water of condensation from the paper dryers in mills for the manufacture of paper, and in augmenting their drying capacity; in performing the same service in connection with drying rooms in cotton, woolen and other mills; in tobacco factories; in connection with steam tables in hotels, etc.; with brewers' kettles, etc.; it has proved specially serviceable in connection with vacuum pans in sugar refineries, and, in a word, in all cases where steam is used for heating purposes by any mechanical device whatever.

Two sizes of these traps are made. The smaller size will hold about 5 gallons, and will drain and return to the boiler the water of condensation from 3,500 running feet of inch pipe; the larger size is double the other in size and capacity.

Electricity in the Wrong Place.

The Albany *Journal* records an incident that exhibits this good servant in the character of a bad master. In one corner of Weed, Parsons & Co.'s printing establishment stands the machine that furnishes the electric light for an adjacent store, the power coming from the engine of Weed, Parsons & Co. One feature of the machine is the armature—a wheel containing coils of insulated wire through which the electricity flows in powerful currents when the apparatus is in operation. This armature revolves with terrific velocity, and constitutes a powerful magnet. One day a young man came in and ground a pair of large scissors on an emery wheel near the generator. Turning to go out past the machine, he carried the scissors carelessly in his hand, when they were immediately drawn into the armature, and were soon revolving with it at frightful speed. The young man got out of the way as quickly as possible, and was unhurt. For a few minutes the machine presented a very startling spectacle. The whirling scissors, twisted and broken, but still adhering to the revolving armature, began to cut the wires, and thus broke the electric current, which escaped in streams from the fractured ends of the wires, and in a moment or two that portion of the room was literally filled to the ceiling with whirling lightning. No one dared to approach the machinery for some little time, but the belt was finally thrown off, and the dangerous show was at an end.

Compressed Air as a Motor.—The question of the economy of the use of compressed air as a motor is about to be tried on an extensive scale at Rochester, N. Y. A large company has been formed in that city, which has purchased an extensive water power, to be utilized in compressing air, which will be conveyed in pipes to the various manufacturing establishments and machine shops of the city, to be used as a motor in place of steam. It will also be used for the propulsion of street cars.

The Keely Motor Again!

At periodical intervals of a year or two apart, that extraordinary What Is It? of distinguished notoriety, known as the Keely Motor, makes a meteoric appearance, and then disappears again from public view, like the materialized ghost at a spiritualistic seance, just when one feels anxious to make its nearer acquaintance. These periodical visitations, if our memory serves us right, have generally coincided with some active demonstration on the part of the company which owns, or claims to own, this remarkable creation of Mr. Keely's genius. Were the Keely Motor Company a railway or mining corporation, it might be suspected that these periodical paroxysms of activity were designed by wily directors for the purpose of "bulling" its stock preparatory to unloading it upon unsuspecting lambs, or for quieting the complaints of other lambs already in the pen and sick with hope deferred. But the Keely Motor Company being neither of these, such suspicion is quite unwarranted.

Our purpose in preparing this article, however, is not to criticise the actions of the Keely Motor Company, of which we know very little, but to give our readers the opportunity of understanding the Keely motor, of which we candidly confess we know still less. The opportunity of presenting the following elucidation (?) of the principles and construction of the Keely motor was afforded us by Mr. O. M. Babcock, of Philadelphia, who is reputed to hold intimate personal relations with the inventor, and who lately delivered a series of lectures at Chickering Hall, in this city, for the avowed purpose, among other things, of giving an explanation of the character and mode of operation of the Keely motor. How far Mr. Babcock succeeded in his task of convincing the public that the motor is anything else than a cleverly devised mechanical puzzle, our readers may judge for themselves by perusing the following statements, which convey in brief the substance of his remarks bearing on the subject.

The first lecture of Mr. Babcock was devoted to a narration of Mr. Keely's personal difficulties and quarrels with the company, in which charges of fraud on the part of the last named were freely made. This branch of the subject has no interest for us. The second lecture, ostensibly devoted to an elucidation of the prinples on which the construction and operation of the motor are based, was a veritable *lucus a non lucendo*—a conglomeration of the most senseless and mystifying jargon that can be imagined, which realized to its fullest the oft-quoted jest that language was devised for concealing thought. The lecturer succeeded, however, in compressing his ideas of the general principles of the machine into the following paralyzing sentence: "Water moved earth, air moved water, ether moved air. Vibrations natural to air would disintegrate water, while air was broken into pieces if it were forced into vibrations common to ether in transmitting light. The compressibility of an elastic fluid was in the exact ratio of the tendency to expand. This was the secret of the Keely motor."

With this explanation, which we trust will make the thing as clear to our readers as it is to ourselves, we pass on to the third lecture, which was devoted to something more tangible—namely, the construction and practical operation of the motor. The engravings given herewith are reproductions as accurate as possible, of diagrams of the machine which the lecturer employed in his explanations. Of these, Fig. 1 represents the generator of the mysterious force; Fig. 2 is a representation of the first practical engine devised to utilize it; Fig. 3, the most recent form of the engine; and Fig. 4, the lever upon which the pressure developed by the generator is indicated. The following explanation of the operation of the motor we abstract from the "near as possible *verbatim* report" of the lecture in the *Scientific American*:

Commencing with the generator, Fig. 1, we are informed that it consisted of a central column A, having four chambers; two side columns B B, each with one chamber, which communicated by descending tubes with the lower chambers of the central column; two

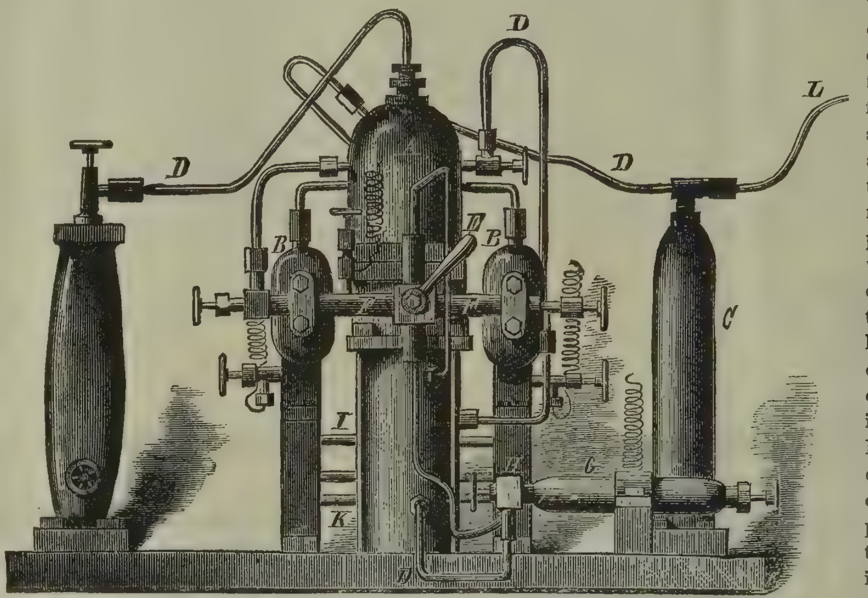


Fig. 1.—THE KEELY MOTOR.

stand-up tubes C C, one front and the other back; certain copper leads or tubes D D, connecting all the before-mentioned chambers; the hand lever E attached to the starting bar F, which last communicates with all the chambers and tubes. The chambers inside the apparatus contained water, and were filled to a definite hight, slightly compressing air into the upper portion of each chamber, thus producing an air cushion, which operated to give an introductory impulse to the agita-

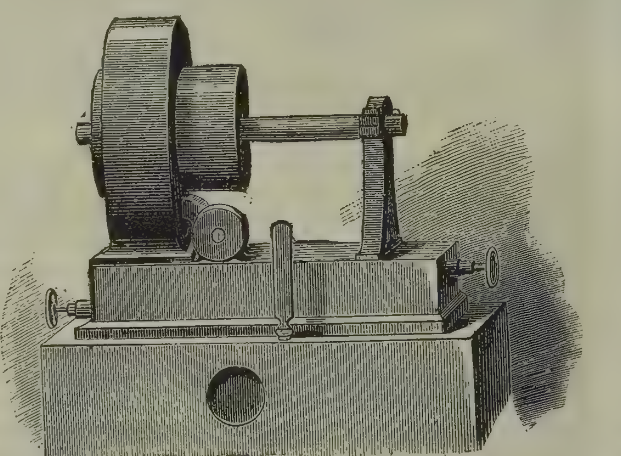


Fig. 2.

tion of the water, which, being expelled downward, aided by the action of gravitation, passed through a complex device situated in the center of the central column (a core running perpendicularly from top to bottom), which dispersed the water into "tenuities," increasing as it proceeded downward through the stages of spray, mist, vapor, etc., into a highly elastic gas or ether. The turning of the hand lever E opened a four-way valve in the center of the starting bar, and disturbed the equilibrium of the water, the opening of the valve producing what might be termed a "vibratory undulation" in the water throughout the entire apparatus. It was produced by the impulsion from the air cushions in the upper portion of the chambers, compressed slightly by the filling of the chambers with water. By means of the agitation thus produced, a minute globule of water was forced through the portion of the apparatus called the expansion tube (the core of the central column), and dispersed from the lower cell at the base of the central column into an adjacent chamber called the undulating or cord tube G, and through a copper lead into the adjacent chamber marked C, by means of the compressing cock H, which could be operated and closed instantaneously. The globule of water, in its descent through the central column and expulsion tube, expanded into vapor, and was forced successively into smaller chambers. It was met in its course downward by opposing currents from the side chambers, coming from the molecular leads I, and atomic leads K, and concentrated in a chamber at the bottom of the central column, not larger than ordinary walnut, and from thence dispersed through a minute orifice into what was called the undulating tube or cord tube G. The moment that this expulsion took place from the lower cell into the cord tube, it was closed by means of a compressing cock or compressor H, and the vapor in the cord tube was held intact. In order to repeat the filling of the cord tube, the compressor had to be opened and closed again. The vapor in the cord tube then passed through the front stand tube C, being intensified in its action in the passage by means of a device which increased its tenuity as it passed upward. From the upper portion of the stand tube it was carried by the tube L to the engine.

Fig. 3 represents the engine as now constructed. It consisted of four compartments A B C D upon a bed-plate. The first compartment A was a cast-iron casing, called the "positive casing," because it carried the positive portion of the apparatus, named as follows: "suspension plate," "wave ring," 150 pins in a "descending vibratory scale," embracing six chords or notes, each chord or note broken up into twenty-five parts—that is, each pin varied one-25th of a tone; also six tuning-forks, a device called the "compound vitalizing medium," another the "vibratory elliptic," and another the "elliptic shaft," "six elliptic vibratory cells," a "positive wave plate," and "three vibratory transmitters." The second compartment contained what were denominated "triple vibratories" for transmitting "sympathies," and a "vibratory indicator." The third compartment, the pulley C, upon which the belting ran, contained a number of devices called "sextrum," "triple vibratory tubes," and a "vibratory bar" passing through the center. The fourth compartment was called the "spiraphone box," and contained the "spiraphone" and "wave plate." All the devices in the several compartments were within casings, and of course could not be seen in the cut. These several devices were constructed in sets of threes; and, in fact, the different portions of the whole apparatus seemed to be arranged in threes; there were only three movable parts, the valves; the negative tube had a capacity of three pints of water, as compared with the nine pints of the positive tube. They all seemed to be arranged in a sort of "rule of three." The power was transmitted by a belt running over the third compartment. The vapor passed from the generator (Fig. 1) to the engine (Fig. 3) and into what was called the "negative tube," upon the bed-plate, adjacent to the spiraphone box E. This "negative tube" had a capacity of three pints. This was connected with a tube near the center of the engine, under the bed-plate, called the "positive tube," which had a capacity of nine pints. From the positive

tube the vapor passed to the positive end of the engine through copper leads, and there acted in succession upon the various devices in the four compartments—not by pressure, but by vibratory waves or "impulsions." The generator occupied a space 5 feet long and high by 2 feet wide. The engine occupied a space 4 feet long by 2 feet wide and high. A 50 horse-power engine would not occupy more than this amount of space, and an engine of 2,000 horse-power could be contained in a room 10 feet square. Being rotary in motion, it required no extra room for the movements of its parts; and water and air being the only materials consumed, the cost of running was practically nothing.

So much for the explanation of the motor, which we hope our readers may find lucid and instructive. On the supposition, however, that there are those among them to whom, as with ourselves, the whole account reads very much like ponderous nonsense, we add a few concluding remarks.

We deem it a waste of energy to join in the general denunciation of the Keely motor as a deception, and of its inventor as a fraud. But a decent regard for public opinion should teach Mr. Keely, and his friends who represent him to be a much maligned and much misunderstood person, that the only thing that he and they can do with any sort of propriety, is to keep silent until they have succeeded in demonstrating the reality of their pretensions by some practical exhibition that will command attention and belief. For ten years we have heard at regular intervals that Mr. Keely was going to do something wonderful. At the end of ten years, he has given us a monumental example of how not to do it. And now, in the name of common sense, what grounds for complaint have Mr. Keely and his friends, if the public, wearied out of patience with repeated broken promises and barren results, and disgusted with the odor of stock jobbery that hangs about his company, should set down the Keely motor, and all connected with it, as but a synonym for humbug and fraud? The world will be much older, we fear, before Mr. Keely "perfects" his motor; but until such time as he does, the public wants nothing out of him or his friends but silence, and mighty little of that.

The Hudson River Tunnel.

Since the lamentable accident last July, by which some twenty lives were lost through the caving in of the temporary entrance to the headings, but little public attention has been atttracted to the tunnel under the Hudson River. Nevertheless, the work is being quietly and rapidly pushed forward. At the time of the accident, many experienced engineers who had previously expressed their doubts as to the safety of the plan of excavating a tunnel of this kind without the protection of shields, reiterated them publicly and forcibly; but the managers of the Hudson River enterprise appear to have remained so firmly convinced that their plan of driving the headings with the simple aid of compressed air to prevent collapse, was the best adapted for the speedy and economical completion of the work, and safe enough, the accident to the contrary notwithstanding, that they decided to continue the work on the plan on which it was begun.

We have already expressed our views on this point so clearly that a repetition of them in this place will be quite unnecessary. It is quite possible that the Hudson River tunnel may be finished without a repetition of the calamity of last summer; such a consummation is devoutly to be wished. It has been urged against the objections to the Haskins plan, that no engineering work of anything like equal magnitude and difficulty has ever been completed, that did not count its victims by the score; that accidents, even with the most rigorous precautions, are in the nature of things unavoidable; and that if the necessary sacrifice of a few lives is to be urged as an insuperable objection against the continuance of the work they are engaged on, the argument, carried to its legitimate conclusion, would practically put a stop to all great works of improvement. The first two of these arguments are admissable, because, unfortunately, they express the true state of affairs. The last would also be admissable were it urged against plans and systems approved by concurrent experience of engineers; but just herein lies its weakness, for Mr. Haskin's plan stands arraigned at the bar of professional opinion, not so much for being an untried experiment of questionable practicability, as for being manifestly extra hazardous. We sincerely hope the tunnel may be completed without a repetition of its past experience, but shall in such

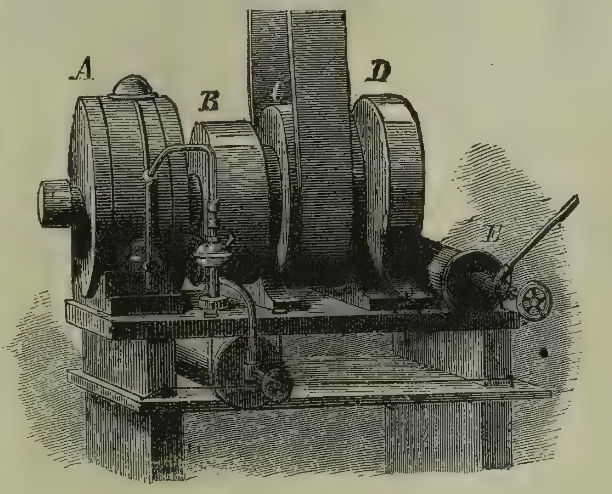


Fig. 3.

event still hold fast to the opinion we have expressed, and regard such a result as due more to good luck than to good engineering, and as a dangerous precedent which engineers may be tempted to follow to their sorrow.

Our purpose, however, in penning this article was not to comment upon the system, but to record the progress of the work. The damage done by the cave in of July last, has, after much difficulty, delay and expense, been repaired by sinking a caisson down to the collapsed portion of the tunnel work, as previoulsy described in this journal. One of the additional safeguards adopted since the work was again pushed forward, is the building of a second air-lock, which was

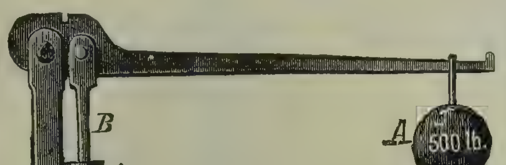


Fig. 4.

necessary to the plan adopted for repairing the break. With the nature and uses of this arrangement our readers are already sufficiently acquainted. At present, it is said, the air pressure used is about two atmospheres; formerly it was greater, but the purpose of those in charge is said to be to work with as low a pressure as possible.

There are three gangs of about twenty-five men each who work in the tunnel eight hours per day each, with twenty minutes for lunch. The caisson which was used to repair the tunnel has become a part of the permanent structure. It was simply a huge strong box which was sunk over the fracture of the tunnel. It was designed by Engineer C. C. Lovejoy. The plan of repairing the break was to sink this box, with the lower side open, until the fractured part of the tunnel was surrounded. Then the lower sides of the box were fitted to the tunnel, the fracture was repaired, the compressed air applied, the water driven out of the tunnel, and the work progressed as before. In making the repairs, it was necessary to use an air-lock in the caisson. This air-lock remains as a permanent safeguard, so that there are now two places of ingress and egress. Yet a third air-lock is being constructed. Whenever there is any alarm in the tunnel, the men have instructions to rush to the air-locks.

Another safeguard that has been adopted is a pilot tunnel, designed by Superintendent J. F. Andersen. This is simply a large iron pipe constructed in sections. As fast as the tunnel advances, a section of the pilot tunnel is pushed ahead. It serves to indicate the character of the soil that will be met with ahead, and also affords a sure footing for the braces that are constantly kept supporting the roof and sides of the tunnel until the mason-work is completed.

At the time of the accident, the north tunnel had progressed 300 feet and the south tunnel only 20 feet. It was not until December 14th that the fracture was repaired and the work of building the main tunnels resumed. It was determined to resume work on the south tunnel, and continue it until the length was the same as that of the north tunnel. Accordingly about 150 feet have been added, and each day adds another 4 feet.

From a *Sun* reporter's late visit to the tunnel, we extract a few of the more interesting observations which he made, including some of his impressions and opinions: "Light is furnished by electric lamps. At the left of the entrance is a telephone communicating with the office, so that there is constant and instant communication. No engineering work was ever constructed with such novel and efficient appliances. Within the tunnel was a busy scene. One gang of men was piling up bricks and carrying them forward to build the wall two feet thick, which is the inner shell of the tunnel. This wall is constantly kept finished up to within about twenty feet of the excavation. Another gang was placing in the newly excavated part the iron plates that form the outer shell of the tunnel and support the roof and sides until the brick arch can be put in place. Another gang was shifting a section of the pilot tunnel; another putting up braces, and still another was removing the silt or mud. As many men as can be conveniently employed—125 in all—are kept at work, and before long both tunnels will be progressing at once. Since the work has been renewed, there have been several alarms among the workmen, causing them to rush to the air-locks. But the precautions are now so great, that Mr. Andersen says he believes another accident is simply impossible. He lives on the premises, and is on hand at a moment's notice to attend to any needed work.

"The south tunnel is just emerging from under the bulkhead that gave so much trouble at the time of the accident. The soil is so porous that the compressed air may be seen at the surface of the river as it escapes from the tunnel through the water, and bubbles up like a boiling spring. The work is progressing smoothly, and Mr. Andersen says that it is all now plain sailing. Thus far about $80,000 have been expended on the New Jersey side, under the auspices of the Hudson Tunnel and Railway Company."

We shall record from time to time the further progress of this work, and trust that we may have no occasion to record anything save such satisfactory progress as here noted. There can be no doubt that Mr. Haskins has demonstrated that his plan permits of the execution of such work as he is engaged on, with remarkable expedition and economy, compared with the older systems in vogue. Whether his sanguine expectations of completing the tunnel without further mishap will be verified, remains to be seen.

Utilizing River Currents.—In parts of Germany it was usual to anchor boats in river currents, with large paddle-wheels to be turned by these currents and used in grinding corn; but with this cheap power there was an inconvenience in conveying the corn to and from the boats. It is now proposed to re-adopt these old floating mills for the driving of dynamo-electric machines, from which light or power may be transmitted to the shore.

Production of Sound by Radiant Energy.

Since our recent publications relating to the remarkable experiments of Messrs Bell and Taintor, which led to the construction of the photophone, by which it was demonstrated that sounds could be transmitted by a beam of light, these gentlemen have continued their researches in the investigation of photophonic phenomena, and have greatly extended our knowledge.

At the time of publishing his account of the photophone, Prof. Bell announced the fact that thin disks of very many different substances emitted sounds when exposed to the action of a rapidly interrupted beam of sunlight. This led to the suspicion that sonorousness under such circumstances was a general property of all matter. The correctness of this generalization was subsequently fully verified. In the first experiments which led to this conclusion, the substances tested were placed in a test tube, the mouth of which was connected with a rubber tube, the further end of which was held to the ear, and the intermitted beam of light then focussed upon the substance in the tube. With this device excellent sonorous effects were obtained from crystals of bichromate of potassa, crystals of sulphate of copper, and from tobacco smoke. These experiments, which were made by Prof. Bell in Paris, were afterwards repeated and greatly extended in Washington by Mr. Taintor, with the modified apparatus shown in Fig. 1. In this, the materials experimented on were enclosed in a conical cavity of brass, closed by a flat plate of glass. A brass tube leading into the cavity served for connection with the hearing tube. With this apparatus Mr. Taintor examined the sonorous properties of a vast number of substances, and found that cotton wool, worsted, silk, and fibrous materials generally, produced much louder sounds than hard, rigid bodies like crystals, or diaphragms such as had hitherto been used. Furthermore, it was found that the darkest shades of silk and worsted produced the best effects. This observation suggested the trial of lampblack. A piece of smoked glass held in the intermittent beam of sunlight, with the lampblack surface towards the sun, produced a sound loud enough to be heard with attention in any part of the room.

These experiments were repeated and verified by Mr. Bell on his return from Paris. By smoking the interior of the conical cavity of Fig. 1, and exposing it to the intermittent beam, with the glass lid in position, he found the sound produced to be so loud as to be actually painful to an ear placed closely against the hearing tube. The sounds became much louder, however, when some smoked wire gauze was placed in the receiver. These extraordinary results suggested the possibility that the substances which showed marked sonorous properties under the influence of intermittent sunlight, might be capable of reproducing the sounds of articulate speech under the action of an undulatory beam from the transmitter used with the photophone, (see page 12 of our January number for this year).

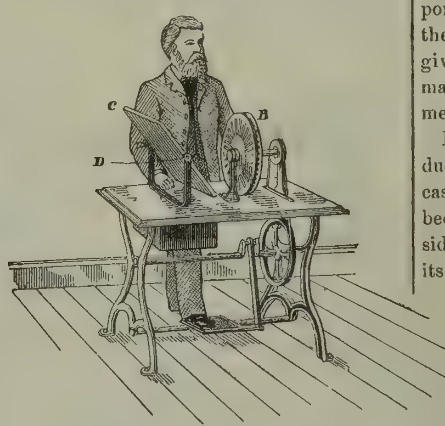
Fig. 1.

The experiments made to verify this suggestion succeeded with lampblack.

Fig. 2 illustrates the mode in which the experiment was conducted. A represents the diaphragm of the transmitter, and B the lampblack receiver with hearing tube. Words and sentences spoken into the transmitter in a low tone of voice, were found to be audibly reproduced by the lampblack receiver at a distance between the speaker and hearer of 130 feet. It has not yet been determined at what distance audible effects could be transmitted with this arrangement of apparatus, as much difficulty was experienced in the above experiment in keeping the light steadily directed on the receiver. The experiment proved, however, beyond question that lampblack could be successfully employed in the articulating photophone in place of the electrical receiver hitherto employed.

Fig. 3 shows an ingenious device employed by these experimenters for interrupting a beam of sunlight for producing distant effects without the use of lenses. Two similar perforated disks are employed, one of which is rapidly rotated, while the other remains stationary. A parabolic reflector is used as a receiver, in the focus of which is placed a glass vessel A containing lampblack or other sensitive substance; and to this is connected the hearing tube. The beam of light is interrupted by its passage through the two slotted disks shown at B.

Fig 2.



The general conclusions arrived at from a great number of experiments with solid substances, are that the loudest sounds are produced from substances in a loose, porous, spongy condition, and from those that have the darkest or most absorbent colors. The materials giving the best effects are cotton wool, worsted, fibrous materials generally, cork, sponge, platinum and other metals in a spongy condition, and lampblack.

Prof. Bell explains the loud, sonorous effects produced from such substances as follows: Taking the case of lampblack as an example, a substance which becomes heated by rays of all refrangibility, he considers a mass of this substance as a sort of sponge, with its pores filled with air instead of water. When a beam of sunlight falls upon this mass, the particles of lampblack are heated, and consequently expand, causing a contraction of the air spaces among them. Under such circumstances a pulse of air should be expelled, as water is expelled by sudden pressure upon a

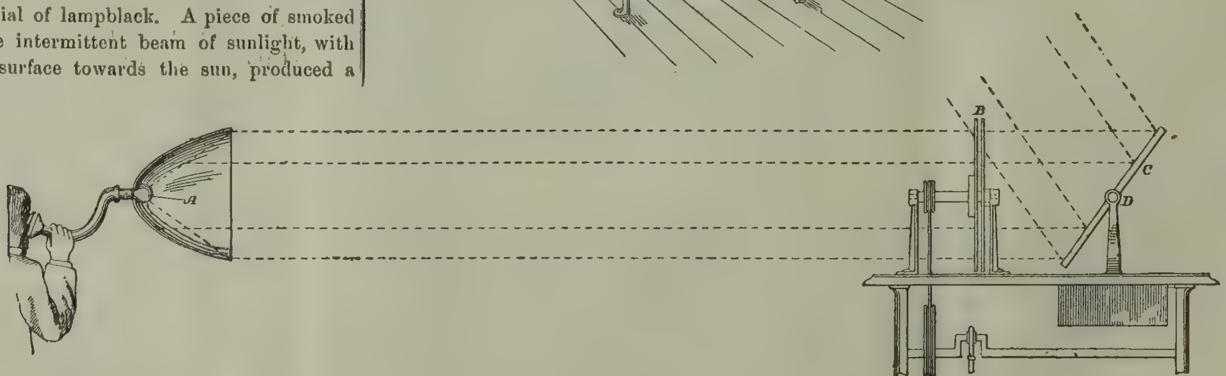


Fig. 3.

sponge. The force with which the air is expelled must be greatly increased by the expansion of the air itself, due to contact with the heated particles of lampblack. When the light is cut off the converse process takes place—the lampblack particles cool and contract, thus enlarging the air spaces among them, and the enclosed air also becomes cool. Under these circumstances a

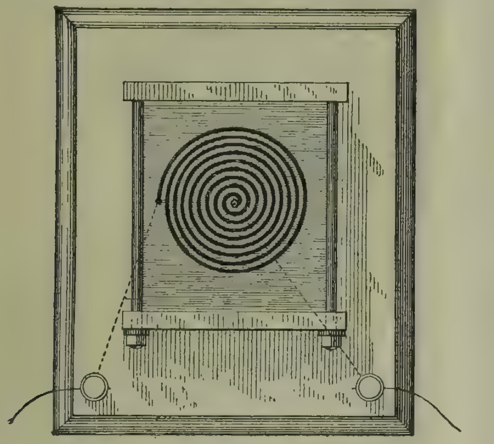


Fig. 4.

partial vacuum should be formed among the particles, and the outside air would then be absorbed, as water is by a sponge when the pressure of the hand is removed. He imagines that in some such manner as this a wave of condensation is started in the atmosphere each time a beam of sunlight falls upon lampblack, and a wave of rarefaction is originated when the light is cut off. We can thus understand, he concludes, how with the disk confined in the cavity behind the diaphragm. In his paper read before the Royal Society on the 10th of March, Mr. Preece describes experi-

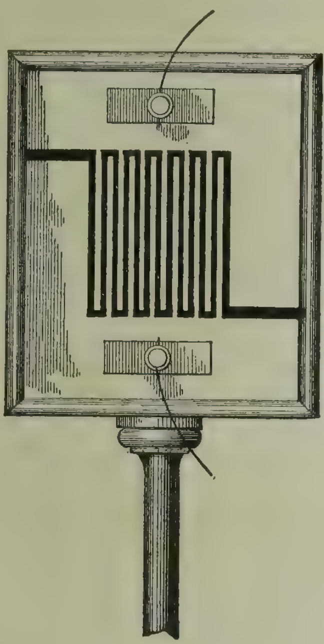


Fig. 5.

ments from which he claims to have proved that the effects are wholly due to the vibrations of the confined air, and that the disks do not vibrate at all.

Prof. Bell dissents from this conclusion, and has ap- with sulphuric ether, ammonia, ammonio-sulphate of copper, writing ink, sulphate of indigo, and chloride of copper; and in the case of gases (which gave better results than liquids), the following vapors and gases were found to be highly sonorous in the intermittent beam: Water vapor, coal gas, sulphuric ether, alcohol,

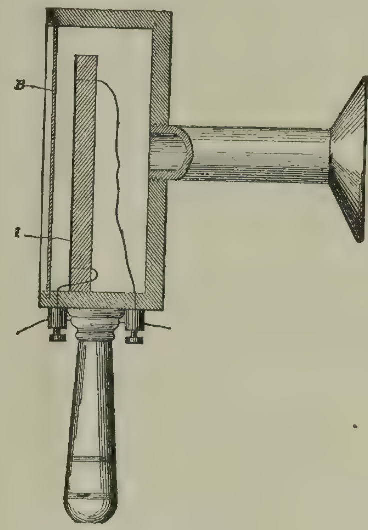


Fig. 6.

ammonia, amylene, ethyl bromide, diethylamine, mercury, iodine and peroxide of nitrogen. The loudest sounds were obtained from iodine and peroxide of nitrogen. These experiments show that sounds are produced by the direct action of intermittent sunlight from substances in every physical condition (solid,

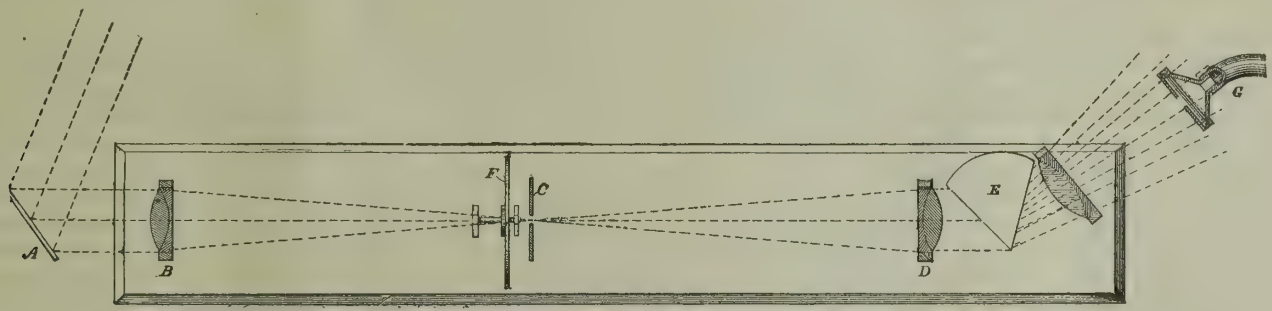


Fig. 7.

it is that a substance like lampblack produces intense sonorous vibrations in the surrounding air, while, at the same time, it communicates a very feeble vibration to the diaphragm or solid bed upon which it rests.

parently demonstrated that a real vibration of the diaphragm takes place in the case of thin disks, independently of any expansion and contraction of the air confined in the cavity behind the diaphragm. The verifi-

liquid and gaseous), and the probability is therefore very greatly increased that sonorousness under such circumstances will be found to be a universal property of matter.

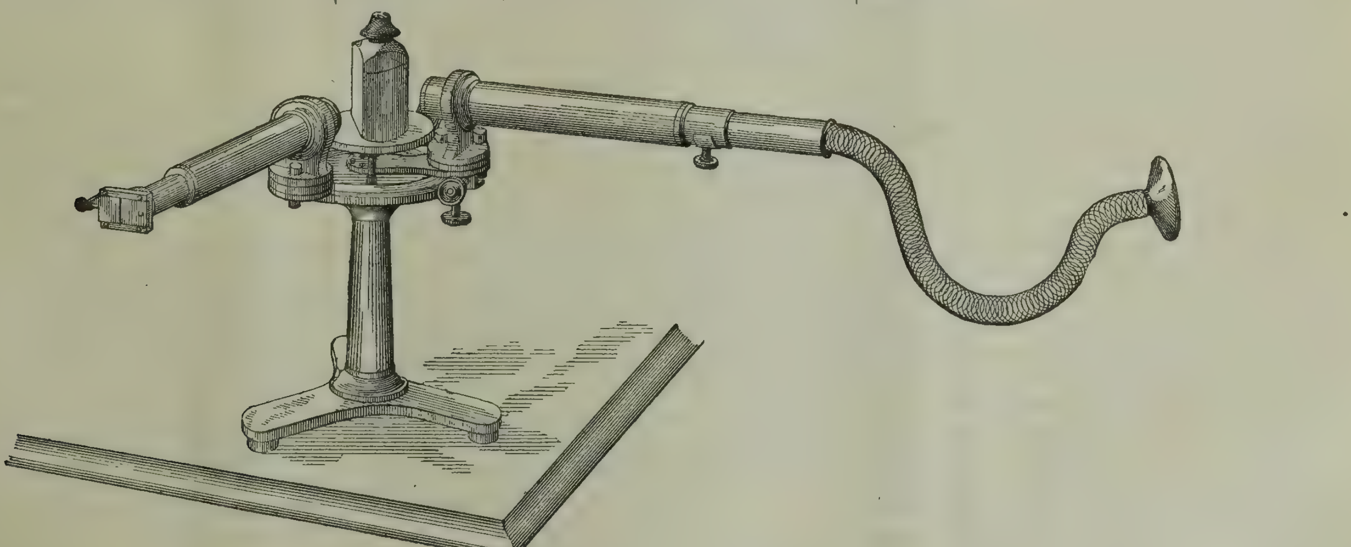


Fig. 8.

This curious fact was independently observed in England by Mr. Preece, and it led him to question whether, in Messrs. Bell's and Taintor's experiments with thin diaphragms, the sound heard was due to the vibration of the disk or (as Prof. Hughes had suggested) to the expansion and contraction of the air in contact cation of this conclusion we shall defer for a subsequent article.

Continuing their investigations, Messrs. Bell and Taintor experimented likewise with liquids and gases. The results obtained, however, were not very decided. In the case of liquids, the best results were obtained

Referring to the photophone, Prof. Bell describes some highly interesting experiments with various substances as substitutes for selenium in electrical receivers. Fig. 4 represents a form of spiral cell of tellurium which gave sonorous effects when connected in circuit with a galvanic battery and telephone and ex-

posed to the action of an intermittent beam of sunlight. The very great molecular disturbance produced in lampblack by the action of intermittent sunlight, suggested the thought that it should produce a corresponding disturbance in an electric current passed through it, in which case lampblack could be employed in place of selenium in an electrical receiver. This turned out to be the case, and the importance of the discovery is very great, especially when we consider the expense of such rare substances as selenium and tellurium.

The form of lampblack cell which was found most effective is shown in Fig. 5. Silver is deposited upon a plate of glass, and a zigzag line is then scratched through the film, as shown, dividing the silver surface into two portions insulated from one another, having the form of two combs with interlocking teeth. Each comb is attached to a screw-cup, so that the cell can be placed in an electrical circuit when required. The surface is then smoked until a good film of lampblack is obtained, filling the interstices between the teeth of the silver combs. When the lampblack cell is connected with a telephone and galvanic battery, and exposed to the influence of an intermittent beam of sunlight, a loud musical tone is produced by the telephone. This result seems to be due rather to the physical condition than to the nature of the conducting material employed, as metals in a spongy condition produce similar effects. For instance, when an electrical current is passed through spongy platinum while it is exposed to intermittent sunlight, a distinct musical tone is produced by a telephone in the same circuit. In all such cases the effect is increased by the use of an induction coil, and the sensitive cells can be employed for the reproduction of articulate speech as well as for the production of musical sounds. It was also found that loud sounds are produced from lampblack by passing through it an intermittent electrical current, and that it can be used as a telephonic receiver for the reproduction of articulate speech by electrical means.

A convenient mode of arranging a lampblack cell for experimental purposes is shown in Fig. 6. When an intermittent current is passed through the lampblack A, or when an intermittent beam of sunlight falls upon it through the glass plate B, a loud musical tone can be heard by applying the ear to the hearing-tube C.

In describing the results of these and other experiments, Messrs. Bell and Taintor use the word "light" in its usual rather than in its strict scientific sense, and have not attempted to discriminate between the effects produced by thermal, luminous and actinic rays, all of which are contained in ordinary sunlight. They call attention to this fact because their adoption of the word "photophone" has been construed to imply that they believed the audible effects discovered by them to be entirely due to the action of luminous rays. They disclaim such restricted interpretation, and explain their meaning by quoting a paragraph from their previous paper on the photophone, in which they say: "Although effects are produced, as above shown, by forms of radiant energy which are invisible, we have named the apparatus for the production and reproduction of sound in this way, the 'photophone,' because an ordinary beam of light contains the rays which are operative." To avoid future misunderstandings on this point, they have now decided to adopt the term "radiophone," a term signifying an apparatus for the production of sound by any form of radiant energy, and limit the words "thermophone," "photophone" and "actinophone" to apparatus for the production of sound by thermal, luminous and actinic rays respectively.

To determine the effects produced by the different forms of radiant energy, Messrs. Bell and Taintor devised the form of apparatus shown in Fig. 7. A beam of sunlight reflected from a heliostat A, is reflected through an achromatic lens B, so as to form an image of the sun on the slit C, then passes through a second lens D, and through the bisulphide of carbon prism E, forming a spectrum of great intensity upon a screen behind the prism. When this is properly focussed, the disk-interrupter F is turned with sufficient rapidity to give 500 or 600 interruptions per second, and the spectrum is explored with the receiver G. With this arrangement and a lampblack receiver, sounds were heard in every part of the visible spectrum (except in the extreme half of the violet), and also in the ultra-red. The sounds increased in intensity as the receiver was removed from the violet towards the red, and reached a maximum far out in the ultra-red. By varying the substance in the receiver different results were obtained, which it would unduly extend this article to reproduce. We will simply note the conclusion that was drawn from the experiments, as follows: The nature of the rays that produced sonorous effects in different substances depends upon the nature of the substances that are exposed to the beam, and the sounds are in every case due to those rays of the spectrum that are absorbed by the body.

These experiments suggested the idea of constructing an apparatus for spectrum analysis, to which they give the name of "spectrophone," which is shown in Fig. 8. The eye-piece of a common spectroscope is removed, and sensitive substances are placed in the focal point of the instrument behind an opaque diaphragm containing a slit. These communicate with the ear by means of a hearing-tube. For the purpose of examining the absorption spectra of bodies in those portions of the spectrum that are invisible, this instrument will doubtless prove a valuable accessory to the spectroscope. When a rapidly interrupted beam of light is passed through any substance whose absorption spectrum is to be examined, bands of sound and silence are observed on exploring the spectrum, the silent positions corresponding to the absorption bands. The ear cannot of course compete with the eye in accuracy in examining the visible portions of the spectrum; but for the detection of absorption bands in the invisible parts of the spectrum beyond the red, it promises to be an invaluable adjunct to the spectroscope.

For the engravings illustrating this article, we acknowledge our obligations to the *Journal of the Franklin Institute.*

To Mark Tools.—Much trouble can often be saved by marking tools with their owner's name, which can be easily done in the following manner: Coat over the tools with a thin layer of wax or hard tallow, by first warming the steel and rubbing on the wax warm until it flows, and letting it cool. When hard, mark your name through the wax with a graver, and apply aqua fortis (nitric acid); after a few moments wash off the acid thoroughly with water, warm the metal enough to melt the wax, and wipe it off with a soft rag. The letters will be found etched into the steel.

Scientific.

Polarization of Sound (*Concluded.*)—The first experiments noted on p. 132, June issue, were made with one L piece in the polarizer, and two in the analyzer. These were increased to three in each during the noting of 455 observations. The result of all these is a percentage of 8.87 hundredths of total polarization—that is, where light would have been totally polarized or quenched, here only about 9 per cent of the sound wave was. On examining the membranes at the reflecting angles of the L's, they were found to have sensible tension. After slackening them, perfectly as it was supposed, 80 additional observations were taken in series of about 9 each, with the following results:

Means of the Above Named Series.

	=	+
	6.07	5.83
	7.19	5.01
	6.43	5.50
	6.30	5.37
	6.34	
Means,	6.47	5.43

$$\text{Per cent} = \frac{6.47-5.43}{6.47} = 16.1$$

Whole number of observations, 80.

At this point the membranes were again examined, and found to have appreciable tension, though supposed to have none. As the gum and dampness dried out, they became light; it was thereupon determined to slacken them with the utmost possible care, and continue the observations. The following table of individual results was then obtained in the manner explained above:

Polarization Continued.

Coal gas in tubes and air outside of tubes. Polarizer having 4 L's and analyzer 5 L's.

Individual Results.

	=	+	=	+	=	+	=	+	=	+	=	+	=	+
	1.2	0.9	2.0	1.0	1.5	1.0	1.6	1.0	1.8	1.4	1.5	0.9	2.0	1.0
	1.5	1.0	2.1	1.2	1.5	1.0	1.4	1.1	1.5	1.2	1.5	1.0	2.1	1.2
	1.5	1.0	1.8	1.1	1.8	1.0	1.8	1.1	1.5	1.4	1.5	1.0	1.8	1.1
	1.5	1.0	2.0	1.0	1.3	1.0	1.9	1.2	1.7	1.2	1.5	1.0	2.0	1.0
	1.5	1.1	2.0	1.0	1.3	1.0	1.9	1.0	1.7	1.1	1.5	1.1	2.0	1.0
		1.0	2.0	0.9	1.2	1.0	1.8	1.0	1.7	1.2	1.5	1.0	2.0	0.9
			2.1	0.9	1.3	1.0	1.6	1.0	1.8	1.0			2.1	0.9
					1.5	1.0		1.1	1.7	1.0				
								1.1	1.7					
								1.1	1.6					
Means,	1.44	1.00	2.00	1.01	1.45	1.00	1.71	1.07	1.67	1.19	1.50	1.00	2.00	1.01

Polarizer turned 90° immediately following each column of results. For gas displaced by air, other conditions the same; deflection, 0.00.

The smallness of these results, compared with those of the previous series, may be explained on the ground of extreme and entire slackness of the membranes; also the slackness is still further evinced by the fact that, when air displaced the gas no deflection of the indicator pendulum was observable in response to the impulses. Tense membranes would have turned the sound waves somewhat, and in the manner of the rebound of a drumstick from a tense drum-head. To obtain the percentage of polarizing effect, we have:

Means of the Above Series.

	=	+
	1.44	1.00
	2.00	1.01
	1.45	1.00
	1.71	1.07
	1.67	1.19
	1.50	1.00
	2.00	1.01
Means,	1.68	1.04

$$\text{Per cent,} \frac{1.68-1.04}{1.68} = 38.1$$

These results establish the following facts for sound waves or for undulations, namely: 1. A decided reflection occurs at a surface separating two gases of different density, confirming the views of Henry and Tyndall in this regard. 2. In repeated reflection from such surfaces the intensity of the final component varies with the relative positions of those surfaces, the same following the laws of polarization in light, from which we conclude that longitudinal undulations can be polarized. With sound polarized, we complete the list of effects for longitudinal undulations which are known to light, namely, radiation, shadows, reflection, refraction, diffusion, diffraction, interference and polarization; and the laws are common for like conditions.

The conclusions to which we are conducted by the foregoing are summed up as follows by Prof. Robinson: 1. That vibrations in extended media, produced from the action of a remote single center of disturbance, can only be longitudinal, even in light. 2. That vibration will be to some extent transversal when due to

two or more centers of disturbance not in the same line, as when two or more independent coëxistent systems of undulations combine into one, or when a simple system is modified by such lateral disturbance as a reflection or a refraction. 3d. That undulations, to be in a condition called polarized, must consist of vibrations which are transversal, and that no necessity exists for assuming vibrations transversal in front of a polarizer.

"SPONTANEOUS COMBUSTION" CAUSED BY NITRIC ACID.—An instructive case involving the ignition of vegetable substances by nitric acid, has lately been the subject of investigation by Prof. R. Haas, of Carlsruhe, in Baden. The occurrence which led to the investigation, was the mysterious burning of a freight car on one of the railways of the Grand Duchy, which, in the absence of any other probable reason, was suspected to have been caused by this acid. Prof. Haas was called upon by the authorities to investigate the subject and report whether nitric acid could have caused combustion under the circumstances or not.

In the experiments which he undertook with this object in view, Prof. Haas endeavored, as far as possible, to imitate the conditions which might be supposed to exist in a freight car carrying nitric acid. A number of small boxes, having a capacity of about four gallons, were filled with hay, straw, tow, paper, etc., all of which materials are used for packing purposes. The boxes were then placed within a larger box, and the spaces between them filled out with hay or tow, to prevent the too rapid radiation of heat. The walls of the outer box represented the sides of the car. The material in the small boxes, which was rather tightly packed, was now saturated with nitric acid, and the effect observed fully confirmed the suspicion which had at first been entertained as to the cause of the burning of the car.

At first, it is reported, reddish vapors, then whitish vapors, were observed issuing from the box, and at length a distinct smoke, emanating from burning vegetable matter. When the cover was lifted, a number of brightly glowing patches were seen, which rapidly spread throughout the mass, and which broke out into a bright flame on access of the air, or by gentle fanning. With red fuming acid, or with acid of specific gravity of 1.48, combustion ensued promptly within a few minutes. With ordinary nitric acid (spec. grav. = 1.395), similar results were obtained, but combustion did not set in so promptly, nor was it so energetic in the beginning. Nevertheless, in three trials with commercial acid, active combustion took place within twenty minutes where the vegetable material was tightly packed in the boxes and thoroughly saturated.

From these results it appears to be probable that the ignition of vegetable substances under similar conditions might be brought about even with more dilute acid, where time enough is given; and this would be especially likely to occur where the material was in large bulk and tightly packed, which would notably assist the retention of the heat.

It has been generally considered probable that "spontaneous ignition," as it is popularly called, could be brought about by nitric acid under circumstances similar to the above, but up to the occurrence of the case here reported, so far as we are aware, no reliable experimental verification of the assumption has been attempted. It may now be regarded as demonstrated that nitric acid saturating vegetable materials, such as straw, hay, tow, paper and the like, in a confined space, will cause their ignition, and the bringing of these substances in proximity to each other, under circumstances where their contact may accidently take place, should therefore be avoided.

IOWA'S WALLED LAKE.—"The greatest wonder in the State of Iowa," says the *Burlington* (Iowa) *Hawk-Eye*, "and perhaps in any State, is what is called the Walled Lake, in Wright county, twelve miles north of the Dubuque & Pacific Railway and one hundred and fifty miles west of Dubuque City. The lake is two or three feet higher than the earth's surface. In some places the wall is 10 feet high, 15 feet wide at the bottom and 5 feet wide at the top. Another fact, is the size of the stones used in the construction, the whole of them varying in weight from 3 tons down to 100 pounds. There is an abundance of stones in Wright county, but surrounding the lake, to the extent of 5 or 10 miles, there are none. No one can form an idea of the means employed to bring them to the spot, or who constructed it. Around the entire lake is a belt of woodland half a mile in length, composed of oak. With this exception the country is a rolling prairie. The trees must have been planted there at the time of the building of the wall. In the spring of the year 1856 there was a great storm, and the ice on the lake broke the wall in several places, and the farmers in the vicinity were obliged to repair the damage to prevent inundation. The lake occupies a ground surface of 2,800 acres; depth of water as great as 25 feet. The water is clear and cold, soil sandy and loamy. It is singular that no one has been able to ascertain where the water comes from nor where it goes, yet it is always clear and fresh."

The story of the "Walled Lake of Iowa" realizes to the full the fact that it is only necessary to give a lie a good start and the truth will have a hard time to overtake it. The extract from the *Hawk-Eye* repeats substantially the old and repeatedly exploded fiction that the natural embankments of the lake in Wright county (and the writer might have added another in Sac county of the same State) were constructed by human agency. We alluded to this absurd statement, with its gross exaggerations and adornments, in our issue for February of last year, and gave the correct explanation of the formation of the "walls" or embankments of these lakes. It is an exceedingly simple one. They have been formed by the action of the ground ice in these lakes—which are very shallow—acting on the boulders with which the bottom of the lake (and the soil of the adjacent country) is plentifully provided. "This ice, by its lateral expansive force, exerted year after year, and from century to century, in time removes everything it meets upon the bottom beyond its reach, finally piling up boulders, sand, gravel and the like, in a ridge of more or less disordered arrangement along the shore, where the expansive force of the ice ceases to act."

Those of our readers who desire to read a fuller explanation of this singular but exceedingly simple natural phenomenon, are referred to the number of our journal mentioned above. And we respectfully recommend our neighbor the *Hawk-Eye* to exercise something of the sharpness which its name suggests, in consulting the very excellent volumes of Iowa State publications, entitled "Geology of Iowa," by Prof. White, in which, on pages 74–78 of Vol. I., the writer of the above quoted extract will find a chapter devoted to the so-called "Walled Lakes," giving the proper explanation of the formation of the embankments, and a complete refutation of the popular fiction that "human hands long ago built their mysterious barriers."

THE PLATINUM PRINTING PROCESS IN PHOTOGRAPHY, which is rapidly growing in popularity, and which gives results very much superior to those attained by the common process of silver printing, is the outgrowth of the work of investigators in the field of photographic chemistry to discover a method that would give permanent prints, in which quality silver prints are notoriously lacking. The platinum process has lately been greatly improved and simplified, so that now it gives very reliable results with ordinary care.

In what follows, we describe the process in its improved form, from a more extended account given by Mr. John Carbutt, a well-known expert in photography: The chemicals made use of are ferric oxalate, potassic oxalate, potassic chloro-platinate and hydrochloric acid. One ounce of the ferric oxalate is taken, and from 40 to 60 grains of the potassic chloro-platinate is dissolved therein. This is the sensitizing solution, and is applied to the surface of the paper to be printed on, with a pad of flannel. The paper is first allowed to dry in the air, and then is perfectly dried with the aid of heat. It is now exposed to the action of light in the usual way, either under the negative in a printing frame, or, in case an enlargement is required, in the solar camera. The print thus obtained is developed in a hot solution of potassic oxalate, afterwards washed in a bath of weak hydrochloric acid to dissolve out any iron salts that may remain in the paper, and finally it is washed in three or four changes of pure water. At first, after exposure, a faint image of the picture appears on the paper in ferrous oxalate, the iron salt being reduced by the action of the light from a ferric to a ferrous salt. The strongly reducing powers of the latter are developed by the subsequent treatment with potassic oxalate, in the presence of which the platinum salt is instantly reduced to the metallic condition wherever the light has affected the ferric salt. Where the action of the light has been strongest, the greatest amount of platinum is precipitated, and *vice versa*. The image, therefore, is obtained in finely divided metallic platinum, commonly known as platinum black.

From the well known power of resistance, or indifference, to the action of the most powerful chemical agents which platinum is known to possess, the unchangeable character of these platinum prints may readily be inferred. In fact, prints by this process have been subjected to the severest chemical tests without having their permanence in the least degree affected. This highly admirable quality, the simplicity of the process, and the beauty of the pictures it affords, promise to bring the platinum process into very general use among photographers, as a substitute for the silver printing process in common use.

THE YIELD OF GOLD in the treatment of auriferous ores in mining operations, is in most cases much less than it should be. The causes of this loss have been variously ascribed by different writers, and numerous modifications of apparatus and processes have been devised to avoid it, or to reduce it to a minimum. Prof. Eggleston, of the Columbia School of Mines, who has paid some attention to this subject, lately gave a lecture in which he presented some interesting data respecting the causes which prevent gold from amalgamating. He mentions as well-known facts, that certain chemical substances like ammonium sulphide and sulphuric acid, form a film upon gold which prevents the mercury from attacking and amalgamating with it. In addition to these facts, he mentioned another, which is new, and which may have a very important bearing on the subject. He affirms that gold may be brought, by hammering, into a condition in which it will not amalgamate with mercury. As much of the ore worked for gold is auriferous quartz, which is crushed to powder in stamp-mills, the bearing of Prof. Eggleston's observation is obvious. He urges, in view of this fact, that in order to reduce the loss of gold, the use of stamp-mills, and other crushing machinery acting by impact, must be abandoned, and that stamp-batteries should be replaced by other forms of pulverizing machinery.

A SINGULAR COLOR CHANGE has been noticed by Dr. Phipson, an English chemist, in connection with a zinc white of dazzling purity, obtained by precipitating a solution of zinc sulphate by means of barium sulphide, submitting the precipitate to strong pressure, and igniting it with limited access of air. If any barium sulphide escapes oxidation, the white compound, on exposure to the sun, begins to darken, and about 20 minutes becomes of a deep slate color. If removed into a dark place, it gradually loses color, and in about five or six hours it becomes again snow-white. This experiment may be repeated with the same specimen as often as desired. Further, this change of color does not take place under a slip of common glass, whether thick or thin; at most the compound takes a slight yellowish brown color on exposure to the sun for two hours. The sample on analysis was not found to contain silver or any other substance known to be actinic.

Explosion of a Portable Boiler.

The case of explosion illustrated and described in the following article, abstracted from the monthly bulletin of the Hartford Steam Boiler Inspection and Insurance Co., was that of a semi-portable fire-box boiler, of the locomotive type, and a variety having an

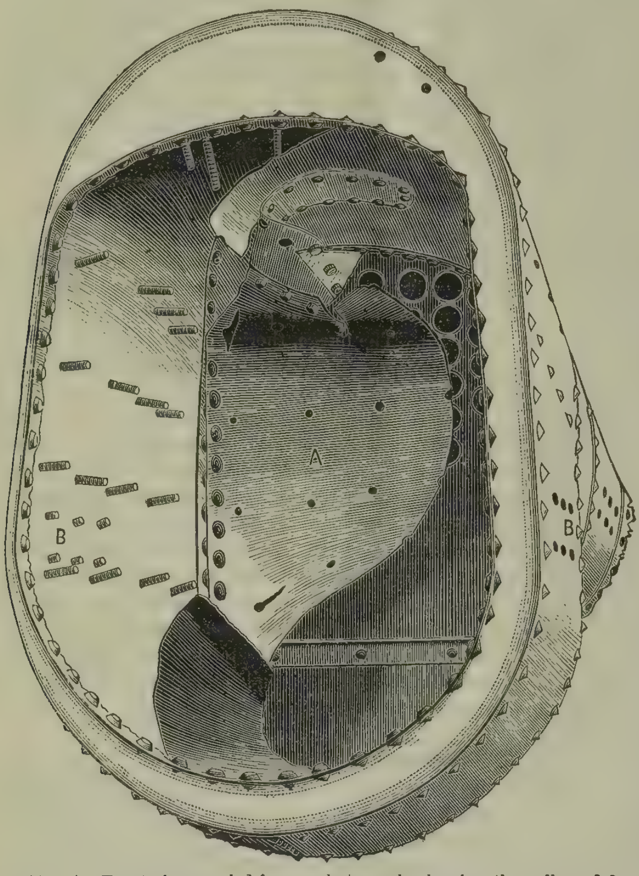


Fig. 1.—Front view, copied from a photograph, showing the collapsed fire-box. A, the left-hand side buckled back upon the tube plate, exposing the interior surface of the outer shell, the screw stay-bolts, and the ends, B, of the leg-bolts.

oval cross section of body. It is a style much used for small powers, and usually has, as this one originally had, an engine attached, and brackets or legs for supporting it either on timbers or on ordinary flooring. The letters B B, Fig. 1, on the body, and the six unoccupied holes on the barrel, indicate the location of a set of four legs upon which this one was mounted by means of tap bolts. It was, when complete, known as a 6-horse engine, and had perhaps done duty as a well-borer in western Pennsylvania, although its history prior to its present ownership was not obtained. For some time it had been used without its engine, to supply steam for refining or re-distilling mineral oils for special purposes, the pressure required being about 50 pounds to the square inch.

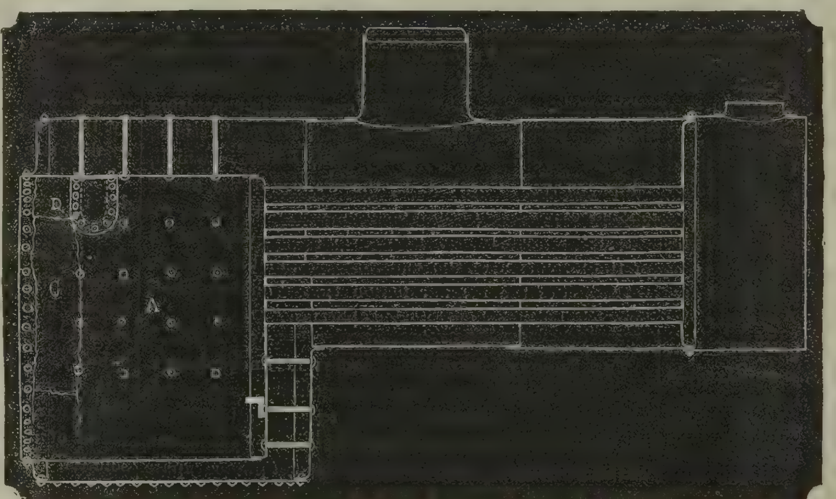


Fig. 2.—Longitudinal section of the boiler, showing lines of fracture of the left-hand wall of the fire-box, the corresponding end of the thin patch, and D, the probable point of initial rupture, indicated by the thin, pouted edges of the hole through which the head of the bolt was drawn, not shown in the cuts.

The principal dimensions and general construction are as follows: Length over all, about $8\frac{1}{2}$ feet, including the smoke arch, which was bolted to the barrel and supported the chimney. The body was 46 inches high by 29 inches wide and 36 inches long, the sides, top and bottom of which were formed of a single plate joined at the bottom. The enclosed fire-box was similarly constructed, varying from the regular form of the shell by having a flattened arch at the top for a fire crown. The dimensions of the fire-box, 25 inches wide, allowed a 2-inch water-space on the sides and bottom, while the hight was such as to give a steam-space about 8 inches high above the crown of the furnace. A front plate flanged inward at its periphery and riveted to the main body plate, and flanged outward on the borders of the opening which corresponded in size and form to the cross section of the fire-box, and riveted to its principal plate, formed the front wall of the steam and water chamber of the boiler. The tube plate, which was also the rear wall of the fire-box and ash-pit, was a plane plate flanged towards the front, and riveted in the usual manner to the principal fire-plate. There were in this boiler 42 two-inch tubes about $4\frac{1}{2}$ feet long, which were beaded at each end. The body of the boiler shell was completed by a rear plate below the barrel, flanged outward, to fit the interior of the barrel, and inward to fit the interior of the body-plate in accordance with the usual American practice in locomotive boiler construction. The fire-box was completed by bolting a cast-iron plate upon the outward flanged opening in the front plate which served as a door-frame, and to carry the front ends of the grate bars, their rear ends resting on an angle bar which was riveted to the tube plate.

Screw stays, arranged in regular rows on the sides, top and rear below the barrel, at intervals of 6 to 7 inches, passed through the outer and inner plates of the body of the shell and the fire-box, and were headed at both ends to prevent the collapse of the fire-box. No stays were placed in the lower semi-circles that formed the "water bottom."

Upon the barrel near the middle of the length of the boiler was fixed a steam dome 11 inches high and 14 inches diameter, made of flanged wrought-iron plates. The description of this boiler is rather more minute than need be, but its simplicity of construction is something notable for this type, although the variety is in common use in some parts of the country. There are but eight principal parts besides the dome and smoke arch, which make a total of eleven plates of wrought iron, namely, two tube plates, two end plates (body), two body plates, two barrel plates, two dome plates, and one in the smoke arch. Other forms of boilers, such as the cylinder tubular and the plain or simple cylinder, are much simpler, having no contained fire-box, and, mostly in New England practice, no steam domes.

The principal fire plate A, Fig. 1, was something less than $\frac{1}{4}$ of an inch thick, while some parts of the shell were $\frac{5}{16}$ of an inch. At the corner of the patch—the point from which the lines of rupture radiate, Fig. 2—a stay bolt passed through the plate and the patch, and both were here much reduced in thickness.

The safety valve bottom presented an appearance indicated in Fig. 4, the light arc representing about the proportion of the seating that had metallic contact. It was found that the steam-gauge pipe had been plugged with solid matter deposited by the boiler water, in which it was very rich.

When the explosion occurred, the proprietor or su-

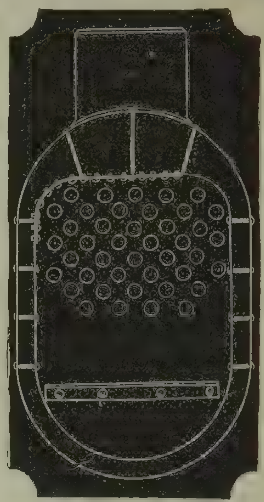


Fig. 3.—Cross section of the body and the patch, showing the screw stay-bolts; the upper one of the left-hand row being the same as D, Fig. 2.

perintendent was directing a man who was examining or repairing the small still or superheater, located

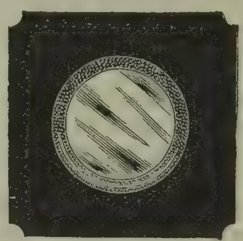


Fig. 4.—Plan of the bottom of the safety valve, the bright portion being indicated by the white arc. "*It did not leak.*"(?)

about 20 feet from the boiler, through which the steam was made to pass. It will be observed that the explosion was caused by the collapse of the furnace; the portion of the left-hand side marked A, folded back upon the tube plate, turning on its vertical seam and buckling so that its upper and lower torn edges are turned toward the front as shown in Fig. 1, which is a cut from a photograph. The boiler, impelled by the reaction of the issuing contents, flew away, slightly ascending and veering some 40 degrees to the right of its extended axial line. It is possible to form a pretty clear idea of its course because it struck and carried away several objects that were in its path through the air before reaching the ground near where it finally rested, about 285 feet away.

The men who were nearest the boiler when it exploded, were blown as by an overpowering gust of wind to a considerable distance and stunned, but not killed; they were out of the track of both water and boiler. It is hardly profitable to speculate on the probable pressure at which the stay bolt in the corner D, of the patch, Fig. 2, gave way, or rather pulled through the patch, for it is deemed enough to know that it was quite sufficient to break this obviously weakest spot in the boiler, and that once broken, an extraordinary and overpowering load fell instantly upon its neighbors, and they gave way in detail.

It is likewise *almost* certain that there was sufficient force stored in this boiler to do the work which we see it has done, and which nothing else exterior to it did

accomplish. Each unit of the water, however small it may be conceived to be, when heated to a high temperature, which was possible only under a corresponding pressure (barring the Donny theory, etc.,) had within itself its own quota of the gross amount of force which was kept confined till the prison was broken, then each minute particle expanded with a suddenness analogous to an explosion, and the whole mass was set in motion towards the broken door of its prison, which now weakened as to its surroundings, grew larger as the crowd pressed against its borders. The opening may not have reached its present size until the boiler was well on its way.

Amber.

The familiar substance known as amber, which has been highly esteemed from remote times for its peculiar properties and for its adaptability for the production of many artistic and decorative objects, is a fossil resin which is found more or less abundantly in several distinct localities. It is a hard, brittle, resinous substance, frequently perfectly transparent, but oftener more or less translucent or clouded, and having a prevailing yellow color, passing from pale straw to a deep orange or purple color. The fact that it develops electrical properties by friction, doubtless was the cause of drawing attention to it from the earliest times, and on this account much of the peculiar esteem in which it has always been held may probably be explained. The ancients, indeed, held this substance in the highest regard as a charm against secret poisoning, and as a preservative against witchcraft and sorcery; and beads, necklaces, ornaments, and carved figures of amber commanded, on account of the peculiar virtues ascribed to it, a fabulous price. The ideas entertained concerning its origin were quite as extravagant.

Leaving out of sight these ancient myths, we may state, coming down to comparatively recent times, that amber was formerly supposed to be of mineral origin; but the fact of its vegetable origin has since been fully proved, both from its frequent occurrence with coal or lignite, and from the occurrence of insect remains which are often found incased in it, but also from its chemical composition and relations, and its physical properties, which fully identify it as a member of the group of resins.

The appearance of enclosed foreign bodies, such as insects, leaves, twigs, etc., which amber very often presents, led very early to the correct explanation of its origin. Pliny states concerning it, for example, that it is an exudation from trees of the pine family, "like gum from the cherry and resin from the pine tree." This opinion is the same substantially as that entertained to-day. Sir David Brewster has shown that in its optical properties it closely agrees with other resinous substances, while it has been proved that both the insects and the remains of plants enclosed in it belong to species that are now extinct. Hence, the inference is fully justified that amber is the resinous exudation of certain trees of extinct species. A species of conifer has been provisionally established as the amber-yielding tree, but it has been shown that many trees, not necessarily belonging to the pine family, may have contributed to its production.

From time immemorial the chief source of the supply of amber has been the shores of the Baltic Sea, and especially on the Prussian coast, the locality between Pillau and Hubenicken furnishing the material in the greatest abundance. It is also found on the coasts of Denmark and Sweden, in Switzerland, near Bâle; the departments of Aisne, Loire, Gard and Bas Rhein; in France; on the coasts of Sicily and the Adriatic, and in various other parts of Europe. Specimens have likewise been found in Massachusetts, New Jersey and Maryland, in this country. It also occurs in Asia, in Greenland, and in parts of Africa.

Respecting the Baltic deposits, which have always furnished the chief supply of amber, the English mineralogist, Prof. Phillips, states that "near the sea-coast in Prussia there are regular mines for the working of amber. Under a stratum of sand and clay, about 20 feet thick, a stratum of bituminous wood occurs from 40 to 50 feet thick, of a blackish-brown, and impregnated with pyrites. Parts of these trees are impregnated with amber, which is sometimes found in stalactites depending from them. The mine is worked to the depth of 100 feet, and from the circumstances under which the amber occurs, it seems plain that it originates from vegetable juices."

After heavy storms, or during the prevalence of certain winds, it is frequently washed upon the shore in quantity, when it is gathered by hand or fished for in the surf with drag-nets. In various localities in this region, mining and fishing for amber are vigorously prosecuted, and large quantities are annually marketed. The chief workings are at Wangen, Sassau, Groskuhren, Kleinkuhren, Kreislaken, Hubenicken, Brusterort and Schwartzort. The average quantity yearly produced is estimated at about 150,000 pounds, of a value of about $380,000.

The price of the article varies greatly, according to quality, and especially according to size, ranging with the fair qualities from $15 per pound where the pieces average nine to the pound, to $2.75 where the pound requires one hundred pieces or more. The value of larger pieces is very variable, as, where these are of unusual size they command very high prices. The city of Dantzig is the headquarters of the trade, and there also it is worked up very largely into beads, mouth-pieces, and other ornaments.

The chemical properties of amber demonstrate its relationship to the resins. Berzelius, who made the first thorough chemical examination of the material, found it to consist mainly of a peculiar resin, *succinin*, insoluble in alcohol, and small quantities (about 10 per cent) of two other resins, isomeric with the first, but soluble in ether and alcohol. By dry distillation it gives off at a low temperature, water, succinic acid, oil of amber, which last was formerly used as a medicine in combination with alcohol and ammonia under the name of *Eau de luce*, though at present its use is obsolete. Its composition would be expressed by the formula $C^{10}H^{8}O$, corresponding to the following percentages: carbon, 78.94; hydrogen, 10.53; oxygen, 10.53. It burns with a pale yellow flame, emitting much black smoke, evolving an agreeable odor, and leaving a shining black carbonaceous residuum.

The chief uses of amber at present, are for manufacture into beads and mouth-pieces for cigar-holders and tobacco-pipes. Especially fine pieces are carved into brooches and other decorative objects. In the East it is said to be far more highly valued, because of its supposed occult virtues. The Turks esteem it highly for the mouth-pieces of their tobacco-pipes, believing it to possess the property of resisting the transmission of infection. It is said that the principal demand for the amber of commerce is among the Armenians, whose traveling merchants distribute it to Egypt, Persia, China and Japan; and great quantities are said to be purchased by pious pilgrims to Mecca, to be offered at the shrine of the Prophet.

Considering the large demand for amber, and the ease with which it can be imitated, it is not surprising that large quantities of counterfeit amber should be made of carefully prepared mixtures of common resins, such as copal, shellac and the like. These imitations are frequently so perfect, even to the clouding, the presence of insects and other objects, etc., that it is impossible to detect the difference between them and the genuine without actual chemical investigation. To aid in the detection of this fraud, the following hints may be useful. True amber requires a heat of 545° to 550° Fah. to melt it, while the counterfeit fuses at a much lower temperature. Copal is yellow, of a more or less deep tint, but uniform throughout, and has yellow points like sulphur on its surface. Amber, in a fragment of 12 centimeters in length, will show a variation in shade, and when rubbed will yield a strong aromatic odor; its imitations will not. Amber may be bent after being smeared with tallow and heated; imitations will not bend. Amber may be cut, sawed, rasped or polished, but cannot be cemented or soldered like copal. The density of amber is 1.09 to 1.11, that of copal is 1.04. Again, true amber is only slightly affected, and after a long time, by ether and alcohol, while the spurious article speedily softens and dissolves in the mixtures.

It is said that by moistening two surfaces of amber with potash and warming them to the proper degree, they may be perfectly united under pressure, and thus a large piece made of several smaller ones. Another plan described, consists in exposing amber covered with sand in an iron pot, to the action of heat for forty hours, or boiling it for twenty hours in rape oil, when the material will become transparent and the pieces will fuse together. As vessels and other objects of great size, made of amber, have come down to us from remote times, the fact suggests the probability that the art of molding and working amber in some such manner was known and practiced by the ancients.

The Tunnel from France to England.

Such has been the progress of engineering science, that thorough ventilation, either during construction or for the permanent submarine railway, has not been considered by either English or French engineers as presenting any insuperable difficulty. Mr. Hawes, the original projector, is even sanguine as to the ultimate success of this Channel tunnel as a financial operation. It is first of all proposed to make shafts and carry preliminary driftways on a small scale, to such a distance under the sea as would decide the practicability of the enterprise on a larger scale. These preliminary works he estimates at $800,000, and he observes that the estimate for the tunnel itself is $50,000,000. On this point we cannot do better than quote the words of the projector of the plan himself, given in Mr. Hawes' pamphlet:

"With regard to this project, it might be well to state that the cost, which had been put at fifty millions, for the construction of the railway beneath the channel, though it appeared a large sum, really embraced about ten miles of railway on each side. In order to get to the tunnel, the railway would have to be commenced in the town of Dover, where a very large station would have to be made, and run from point to point along the coast until it turned down near the South Foreland. When it emerged on the other side on the French coast, several miles of railway would also have to be made, to join it with the Northern of France line, so as to be able to get to Paris and Belgium. In fact, the capital of fifty millions would be for about 31 miles of railway in all. That would make the railway cost $1,500,000 per mile, about one-third the cost of the Metropolitan railway, and about one-sixth the cost of the railway from Charing Cross to Cannon street and London Bridge, which he had himself constructed, so that it was not so formidable as it at first sight appeared."

The Milwaukee Industrial Exposition.

The first annual exhibition under the auspices of the Milwaukee Industrial Exposition Association, will open on Tuesday, September 6th, and close on Saturday, October 15th, 1881. The association, which has assurances that its buildings will be completed before July 31st, invites American manufacturers, inventors, merchants, producers, artists, etc., "to avail themselves of the opportunity to exhibit the products of their skill and industry in one of the most complete and substantial exposition buildings ever erected wholly by private enterprise in the United States."

Pine Cones are said to be very generally used in Europe for kindling coal fires. When dry, they are readily ignited with a match, and are free from dust and insects. Two of them are enough to start a fire of wood, and a handful suffices for starting a coal fire. The hint might be made useful where bituminous coal is the common fuel and pine cones are abundant.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	20 00 a 22 00
Pine, common box	17 00 a 18 00
Pine, common box, 5/8	15 00 a 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	28 a 30
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	22 a 25
Pine, strip boards, merchantable	16 a 18
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	22 a 24
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch	43 a — 44
Spruce wall strips	14 a — 15
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	45 00 a 50 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	90 00 a 110 00
Black walnut, 5/8-inch	75 00 a 85 00
Black walnut, selected and seasoned	110 00 a 150 00
Black walnut counters, per ft	15 a 20
Cherry, wide, per M	85 00 a 100 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, 5/8-inch	30 00 a 35 00
White wood, 5/8 panels	40 00 a 45 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	1 75 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 31
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	— —	a 3 00
Up Rivers	7 37½	a 7 62½
Jersey	— —	a — —
Haverstraw Bay	7 50	a 7 62½
" " choice	7 25	a 8 00
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown, per M.	10 00 a 11 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	23 00 a — —
Trenton	22 00 a 23 00
Baltimore	38 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	23 50 a — —
" Glengarnock	22 00 a 22 50
" Eglinton	20 50 a 21 00
" American, No. 1	23 00 a 24 00
" American, No. 2	21 00 a 22 00
" American, forge	19 00 a 20 00

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 50 a 6 75
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7 a — 7¼
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12½ a — 13
No. 2	— 11 a — 12

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a — —
do do No. 1, blue, in rough	— 85 a — 95
Bedford Stone	1 25 a — —
Berlin Freestone, in rough	— 75 a 1 00
Berea Freestone, in rough	— 75 a — 00
Brown Stone, Portland, Conn	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a — —
do Mary Point Brown Stone	1 00 a — —
do do Olive Stone	1 00 a — —
Brown Stone, Belleville, N. J.	1 00 a 1 35
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a — —

PAINTS.

*Carmine, American, per lb, gold	6 00 a 6 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton, gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6½ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil, gold	— 9½ a — 10½
Litharge	— 6½ a — 7
*Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
*Orange Mineral, English, gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
*Vermilion, Chinese, per lb	— 85 a — 90
*Vermilion, Trieste	— 70 a — 75
*Vermilion, quicksilver, bags, gold	— 55 a — 57½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
*Zinc, white French, dry, (Red Seal,)...gold	— 8¼ a — 9
Zinc, white French, in oil, gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 20 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — 18
Goat, " "	— 21 a — 25

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	— 90 a — —
" finishing	1 00 a — —
Rockland, common, cargo rate	1 00 a — —
" finishing	1 10 a — —
Ground	1 00 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	2 00 a 2 25
Masons, do	4 00 a 4 50
Plasterers, do	4 00 a 4 50
Carpenters, do	4 00 a 4 50
Plumbers, do	4 00 a 4 50
Painters, do	3 00 a 3 50
Stone-Setters, do	3 00 a 3 50

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—In the lumber market the past month business has remained in good shape, all descriptions of stock finding demand and commanding full former rates readily. The various outlets for stock have been well represented, local manufacturing in its various forms requiring a full assortment, and the consumption for building purposes rather tending to increase.

In the brick market the position has been almost solely in sellers' favor, prices still creeping steadily upward, with a strong, confident feeling extant at the close. The addition to cost induced some buyers to pause and consider; but if any concluded to withdraw, others came forward to fill their places, and there was no abatement whatever to the demand.

In the lime market there has been positively nothing new. The demand has continued good and general, with an exhaust fund for pretty much all stocks, either on spot or afloat, and sellers have obtained full former rates without difficulty.

In the lath market there has been some irregularity shown since our last report. At one time the accumulation of stock was quite full, and one or two holders appeared to become a little alarmed, leading to a hasty offering and sales at a shading from former rates.

In the cement market there has not been much change in the general features of the report on the market for domestic grades. There has been the same free distribution of the product as rapidly as it becomes ready for handling, with an ample supply of back orders on hand; and the mills are well assured of all the business they can attend to for months.

In the hardware market buyers in general have moved with caution, and with an evident intention to handle nothing beyond immediate and well assured wants, a great many of the leading descriptions of stock finding positive neglect.

In the paint market demand has been moderate and uncertain, with the market showing no very noticeable features for the month.

In the metal markets manufactured iron has been selling moderately, with no change of importance to note at the moment. American pig iron has been dull and drooping, and stocks cannot be placed until buyers secure some advantage. Scotch pig has been offered freely from landing parcels, and occasionally at very low rates, which induced some buying. The natural demand, however, has been limited, and business as a rule unsatisfactory. Domestic pig lead has not been much wanted beyond the ordinary run of trade and orders, and the tone of business has been quite dull. The supply, however, has been under good control, and holders have not been inclined to offer except at about former rates. Manufactured lead has been steady. Pig tin has gone out slowly, and principally in small lots as wanted for immediate consumption. The supply, however, has been carefully adjusted to the wants of the market and held quite steadily. Tin plates have secured a fair jobbing outlet and the market a steady tone, but without inclination to buoyancy. Zinc has had an ordinary jobbing sale and a pretty steady market.

Cotton Fair at Atlanta, Ga.

A grand international exhibition of the appliances and machinery used in raising, preparing and manufacturing cotton, with samples of cotton fiber and fabrics, and all other matters bearing upon the cotton interests, is to be held at Atlanta, Ga., during the months of October and November.

Home Department.

Improved Radiators for Steam Heating.

Our illustrations give representations of several improved forms of radiators for steam heating, which are probably as simple, compact and efficient in service as any that could be devised. The principle that has been followed in their construction, is to secure as large a radiating surface as possible as compared with the steam space of the tubes or plates, thus insuring the utilization of all the heat practically obtainable from the steam, while sacrificing nothing of compactness and elegance of form and appearance.

Fig. 1 represents a circular form of "Reed's Improved" radiator, made up of the same members as will be found described in our March number for 1880, only differently disposed. The form of the tubes is that of a flattened ellipse, having a longitudinal corrugation or enlargement to increase its radiating surface. The tubes are compactly arranged, permitting however of free circulation of air between them. No joints are visible, the tubes being expanded into the base by hydraulic pressure, the joint being made with a copper washer on the end of the tubes. The form and arrangement of the tubes permit of every portion being utilized as effective heating surface, and the appearance of the device in its various forms is graceful and elegant.

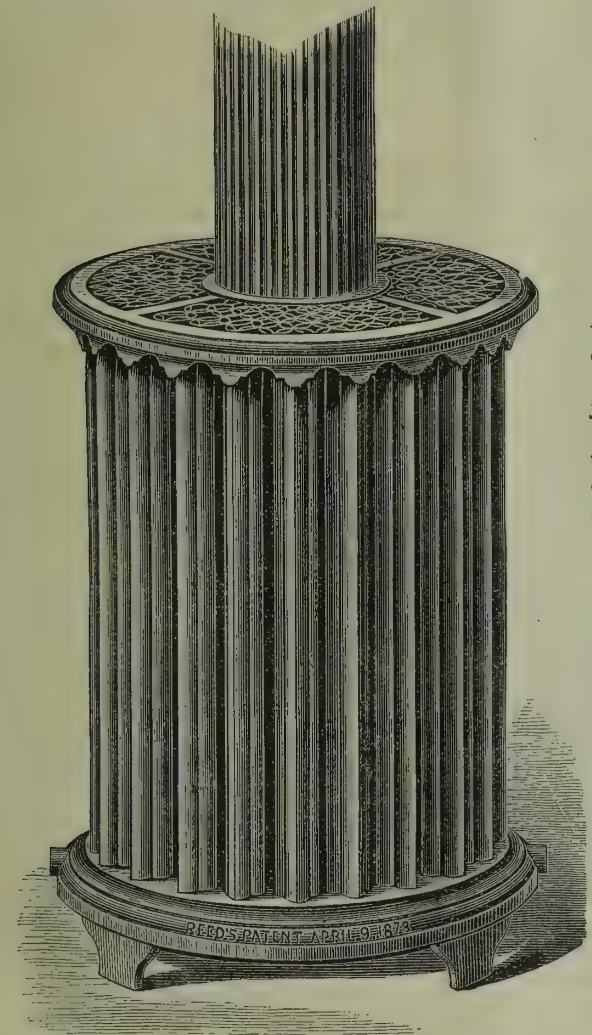


Fig. 1.—Reed's Improved Radiator—Circular Pattern.

Fig. 4.

Figs. 2 and 3 represent two forms of Gold's Indirect "Pin" radiators, differing from each other only in the mode of admitting the steam. In the "Utica" pattern (Fig. 3) the steam is admitted at the end of the terminal plate, and traverses the plates from end to end. In Fig. 2 the steam admission is at the center of the plates, from which it is distributed to the right and left, a divisional plate in each of the members providing for its circulation.

The design in constructing these radiators, as well as those previous described, is to furnish them with so extended a radiating surface that all the heat practically available from the steam shall be utilized. For this purpose, the outer or radiating surface of these radiators is extended by means of projecting points to three times the area of the inner or steam surface, so that the air passing over this surface is thoroughly and pleasantly warmed, but never so highly heated as to become objectionable or injurious.

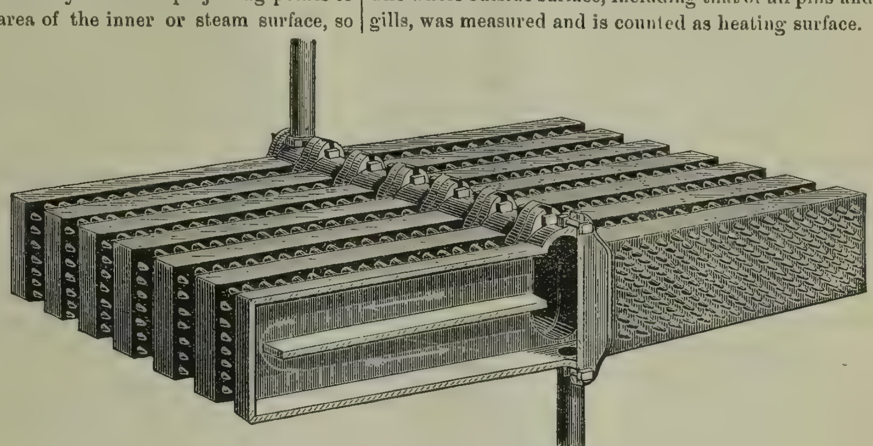


Fig. 2.—Gold's Indirect "Pin" Radiator.

It is impossible for a volume of air to pass through a stack of these radiators without being completely and promptly warmed, as the main current is broken into numerous secondary currents, which receive the heat rapidly, and throw it off freely and quickly at the radiating points.

The large steam chambers of these radiators are an especially valuable feature, because if the steam chambers were small, a high pressure would be required to force the steam through them; whereas in this system, the steam being received at once into a large chamber, has but a short distance to go, and but small obstructions to overcome in passing to the radiating surfaces, thus rendering this apparatus available with an extremely low pressure in buildings of even the largest size.

We add in conclusion the results of some instructive experimental tests made to determine the heating effects of several kinds of "indirect" steam heaters when different quantities of air are made to pass over their surfaces. These experiments were made some years ago by Mr. C. B. Richards, a well-known engineer, and the results given below are presented on his authority.

The numbers in the body of the first table indicate the heat units given out per hour, by one square foot of external heating surface, for each degree Fahrenheit difference between the temperature of the steam in the heater and that of the cold air before it touches the heater.

The quantities of air are expressed in cubic feet per hour per square feet of external heating surface. The density of the air is that due to a temperature of zero, Fahrenheit.

The heaters named are the "Gold Pin," the "Novelty," the "Gold Whittier," (a radiator with vertical flanges) and a box coil of straight 1-inch wrought iron pipes, about four feet long, in vertical rows alternately, two pipes and three pipes high, as shown in Fig. 4. The pipes were placed as closely together as the return bends would permit. The "Gold Pin" and "Novelty" are both manufactured at Westfield, Mass. The whole outside surface, including that of all pins and gills, was measured and is counted as heating surface.

Quantity of Air. Cub. Ft.	KIND OF HEATER. Gold Pin.	Novelty.	Gold Whittier.	Pipe Coil.
100	1.58	1.48	1.28	1.42
200	2.66	2.53	1.94	2.03
300	3.68	3.46	2.48	2.51
400	4.63	4.32	2.95	2.91

English heat units.

The temperatures which the air will have when it issues from the heaters, if at zero, Fahrenheit, when it first touches them, and if the heaters are filled with steam at one pound gauge pressure, will be

Cu. ft. air.	Gold Pin. Degrees.	Novelty. Degrees.	Gold. Whittier. Degrees.	Pipe Coil. Degrees.
100	160	156	135	147
200	139	132	102	106
300	129	121	87	87
400	121	113	77	76

Fahrenheit temperatures.

These experiments speak for themselves as to the effectiveness of the "Gold Pin" radiators, which were adopted and put into the new Capitol at Hartford, Conn., on the results of these tests.

The radiators described in this article are manufactured by the H. B. Smith Co., whose foundry is at Westfield, Mass., with office and warerooms at No. 8 Dey street, New York.

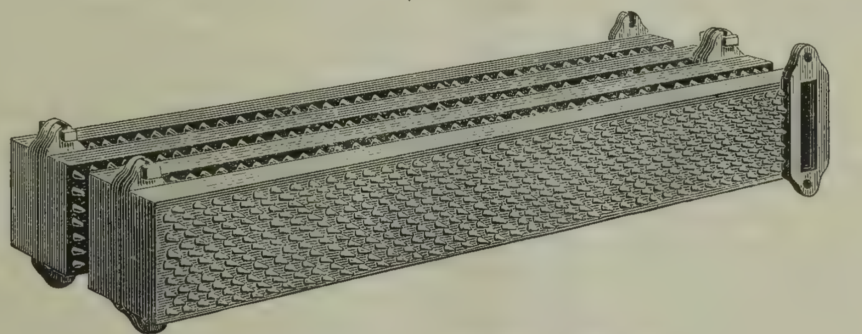


Fig. 3.—Gold's Indirect "Pin" Radiator—Utica Pattern.

Hurrying Work.—A mechanic who is always in a hurry is incapable of doing good, honest work. The excitable man who is always "flying around," and whose tools are never at hand when wanted, does not amount to much; he may be busy all day, and apparently—in fact, does work hard, and seems to get over a great deal of ground, but what he does do is neither fine nor substantial. The cool, calm workman who allows himself neither to be driven nor persuaded to do more than a solid day's work, is the man who

leaves his impress on each piece of work he turns out, and years hence it may be found as good and as solid as the day he completed it; but where! O where! will be the work that was thrown together at the same date by the man who was always "flying around?"

Sunshine in the Workshop.

An interesting and an exceedingly useful pamphlet has been published by Dr. J. N. Farrar, as a reprint of a report made to the American Dental Association, on the "Importance of Direct Sunlight in the Workroom." His object is to prove that the policy of working all day in a north light is not only unhealthy, but that shaded or reflected light is no better for doing fine work than direct sunlight, if it be indeed equal. After considering the scientific relations of the subject to mechanical art and general health he gives a leaf from his own experience for the benefit, not only of dentists, but of all who do fine work in any trade or profession. He had a bay window built on the north side of his office, with very large north and west side windows and a skylight five feet square, affording as much light as can well be obtained from the north. Entering this bay in a high degree of health, and working closely, he found himself growing weak and very pale. At the end of the year he had a cough, which not only became in a measure chronic, but was steadily increasing to such an extent that his acquaintances believed he had consumption. This weakness of the general system was followed, after about a year, by a trouble in the eyes, causing pain in them when closely used on fine work, especially in cloudy weather. He then built another bay window, on the south side of the house, arranged so that he could regulate the degree of intensity of the light. Before six months, under the same amount of labor and close confinement, he found his cough had left him, and his vision had become strong. After operating in this south bay window eighteen months he moved to an ordinary southern window, where he continued to experience the same benefit, though to a more limited extent. Subsequently he worked in a west window, where the light did not shine into his office for three months, and his health and eyes failed him again. As spring approached, and the sun rose high enough to shine above the opposite houses, his health improved and his eyes became stronger until the spring foliage on the trees before his house cut off the light, when his eyes began to pain him again. He then used an east light, the best he could command, which in the morning admitted the sun's rays, and his health and eyes improved again; but no light was as good as the southern. Next to a skylight observatory, with suitably shaded windows all around, and a chair in the center, he considers the most practical arrangement to be a very prominent bay window projected from the southwest corner of a block of buildings, so planned as to permit the sunlight to shine into it from morning until evening.

Drink for Laborers.

When you have any heavy work to do, do not take either beer, cider or spirits. By far the best drink is thin oatmeal and water, with a little sugar. The proportions are a quarter of a pound of oatmeal to two or three quarts of water, according to the heat of the day and your work and thirst; it should be well boiled, and then an ounce or an ounce and a half of brown sugar added. If you find it thicker than you like, add three quarts of water. Before you drink it, shake up the oatmeal well through the liquid. In summer drink this cold; in winter, hot. You will find it not only quenches thirst, but will give you more strength and endurance than any other drink. If you cannot boil it, you can take a little oatmeal mixed with cold water and sugar, but this is not so good. Always boil it if you can. If at any time you have to make a long day, as in harvest, and cannot stop for meals, increase the oatmeal to half a pound, or even three-quarters, and the water to three quarts if you are likely to be very thirsty. If you cannot get oatmeal, wheat flour will do but not quite so well. For quenching thirst, few things are better than weak coffee and a little sugar. One ounce of coffee and half an ounce of sugar, boiled in two quarts of water and cooled, is a very thirst-quenching drink. Cold tea has the same effect, but neither is so supporting as oatmeal. Thin cocoa is also very refreshing and supporting likewise, but is more expensive than oatmeal.

A World's Fair in Boston.

The New York project for a World's Exhibition in 1883 having fallen through, Boston has caught the inspiration, and proposes to materialize the idea in the year 1885. A guarantee fund of $3,000,000 has already been secured, and a wide-awake committee appointed to ascertain if the enterprise is possible.

Miscellaneous and Advertising.

It is estimated that Minnesota requires five million pounds of twine to bind its wheat crop, and Farmers' Board of Trade recommends home manufacture and the cultivation of hemp for that purpose.

Joslin's jig saw strain is invaluable, and its advantages are so evident that no wood-worker can afford to be without it. Mr. I. R. Joslin, of 91 Liberty street, New York, is the manufacturer of this excellent device.

Parties needing wood-working machinery, engines, boilers, etc., should communicate with Symmes & Perine, of 84 Pike street, New York. They have a choice and varied stock, to which they are adding constantly.

Those contemplating taking out patents, would do well to consult with E. R. Brown, of 37 Park Row, New York. Mr. Brown is an attorney of many years' standing, and his wide experience and knowledge of the business commend his services to inventors.

The Clark Colored Brick and Terra-Cotta Co., of Glens Falls, N. Y., manufacture pressed front bricks, and bricks molded in red and buff in great variety of shape. They also make architectural terra-cotta in red and buff; crestings, string courses, tiles, panels, moldings, finials, window caps, chimney tops, etc.

Northrop's paneled sheet-iron ceiling is permanent and fire-proof. It will not crack, stain or fall off like plaster; will not shrink or burn like wood. The manufacturers, A. Northrop & Co., of 97 First avenue, Pittsburgh, Pa., have applied over two million square feet of this roofing in various parts of the country.

Owners and managers of large establishments throughout the country, will find information of positive value in our 75-page illustrated pamphlet, entitled "Useful Information for Steam Users." It contains data on the care and management of steam engines and boilers and rules for engineers and firemen. Sent for 25 cts. in postage stamps. The J. N. Mills Publishing Co., 165 Broadway, New York city.

The six Eastern States, it is said, produce one-half of the woolen goods, four-fifths of the cotton fabrics, and three-fourths of the boots and shoes made in the United States. Out of a total of 11,000,000 cotton spindles in the country, nearly 4,000,000 are in operation in Massachusetts and nearly 5,000,000 in Maine, New Hampshire, Rhode Island and Connecticut.

The Curtis regulator is a perfect automatic regulator for steam, water and other fluids. It possesses the merits of simplicity and sensitiveness, and, having no glands or packing the seat may be made of any suitable material for steam, gas, air, water or other fluids. The manufacturers—the Curtis Regulator Co., of 59 Beverly street, Boston—will be glad to furnish circulars on application.

The inventive talent of our country has perhaps produced no device that has proved of greater practical value than the modern brick machine; and in the machine of Chambers, Bro. & Co., of Philadelphia, is to be found the utmost perfection of detail. This machine is guaranteed to make 30,000 bricks per day, and the manufacturers state that they will erect the same wherever desired, subject to trial and approval, which is certainly a very fair offer.

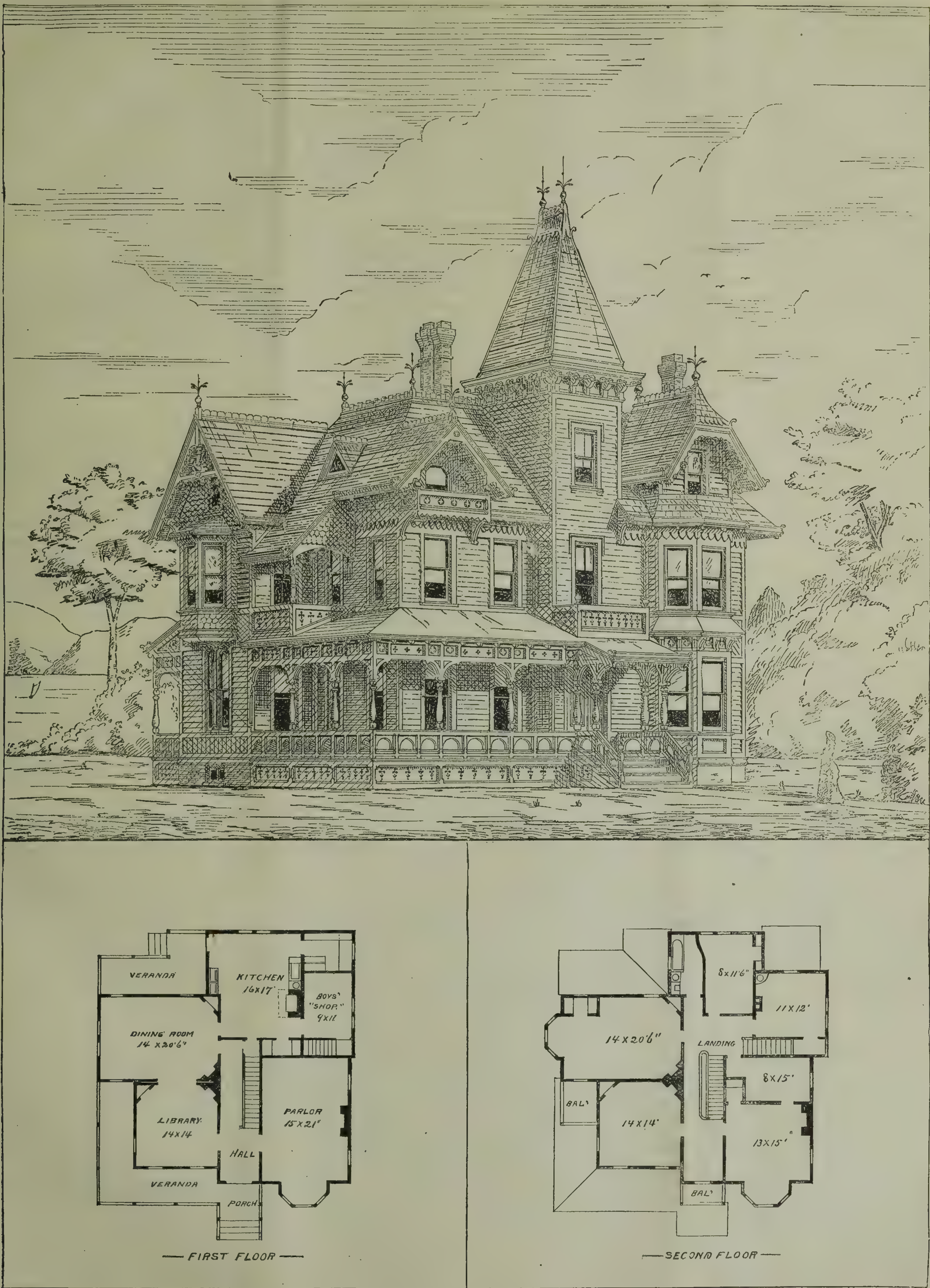
The unprecedented activity in building has created a great demand for freight and passenger elevators, and the resources of makers of these conveniences have been taxed to their utmost. Among the most enterprising manufacturers in this line are L. S. Graves & Son, of Rochester, N. Y., who manufacture passenger and freight elevators, both screw-geared and hydraulic. This firm are receiving their share of orders, and their works have been busily engaged for months past in filling contracts. We predict for these elevators a still greater measure of success when their merits become generally known hereabouts.

Suburban Residence.

The house design presented on the opposite page will occupy one of those charming sites for which Nyack is noted, commanding a favorable view of the Hudson and surrounded by all the natural attractions of that delightful locality. The internal arrangements were planned to suit the particular requirements of the owner, and certainly show a most desirable disposition of the accommodations. The aspect is east, and hence, it will be noticed, the library and dining room have a sunny and cheerful exposure. The front bay window not only affords a more extensive prospect to the parlor and room above, but adds to the spaciousness of those rooms. The south oriel occupies a decidedly appropriate position and occasions no obstruction to the carriage drive to the rear of the 60-foot lot on which the house is located. In connection with the kitchen a spacious store room is fitted up with pastry board, dresser, bins, etc., and a kitchen pantry is also finished under the servants' stairs. Stationary wash trays are located so as to interfere as little as possible with the culinary work. Long windows communicate the dining room with the front and rear porticos. The cellar stairs are underneath the principal flight, and above the latter are the stairs to attic, where a servant's room and clothes room are finished off. The cellar extends under the entire building, excepting beneath the store room. The house is heated throughout by Graff & Co.'s No. 5 hot blast furnace, and is finished replete with all the modern conveniences of a first-class dwelling, the plumbing arrangements being according to the most improved method. In construction, the work is thorough and first-class throughout. The frame is sheathed with boards and felt beneath the clapboards, and the slopes of the roofs are covered with slates. The first and second floors are laid with narrow mill-worked white pine flooring, and the attic with flooring of medium width. The architraves and base boards, as well as the inside details in general, are of unique and original design, producing a beautiful effect at a comparatively small expenditure of material and labor.

The structure is conspicuously exposed from each direction and the design has been treated accordingly, presenting an interesting outline from every point of observation. Although in a hastily-prepared perspective sketch much of the expression is lost with the absence of well-defined, characteristic details, yet it will be readily seen that by a tasteful introduction of colors and contrasts this house can be made extremely attractive.

As to the cost of the building, so much depends on circumstances and conditions that it is hardly fair to attempt an approximation. Under favorable circumstances and judicious management the total cost, including heating, plumbing and mantels, should not exceed $4,750. Mr. Horace Greeley Knapp, of 61 Broadway, New York city, is the architect.



DESIGN FOR SUBURBAN RESIDENCE, COSTING $4,750.

Sewerage Systems in European Cities.

At a late meeting of the Engineers' Club of Philadelphia, Mr. Rudolph Hering, Assistant Engineer of the Survey Department, who recently made an examination of the sewerage works of the principal European cities, gave a general account of his trip. He sketched the gradual development of sanitary works, alluding to the indifference upon the subject in the Middle Ages, the consequent terrible epidemics, the slow development of the recognition of its importance, and to the present difference of opinion as to the proper methods, resulting in a great variety of design in the existing works.

He then described the various general designs in historical order, and compared the efficiency of present methods. The same system and ideas will not be applicable to every town. The topography, physical features and the customs of the people may necessitate radically different plans. Rain water, in some cases, might be led off on the surface; in others, like Philadelphia, it must, to a great extent, be carried away in deep sewers. The "separate system," which is common in England, and has recently been partially executed for Memphis, is therefore not economical here, except in localities where the present sewers are found entirely unsuitable for the proper conveyance of house water, and could be used for storm water alone. When the entire system is built anew, "the combined system" has been adopted, the best example of which is found in Frankfort-on-the-Main.

Mr. Hering found, compared with American cities in general, that much greater care was given not only to the design and construction, but especially to the maintenance of the sewers. Frequent and thorough inspection was found to be exercised everywhere. A regular system of cleaning was considered as important as the building of the sewers themselves. He walked through hundreds of them, and seldom perceived an odor as strong and disagreeable as is frequently noticed on our sidewalks near an inlet. In Paris the "egouts" are frequently visited by strangers, including ladies. In Hamburg, the Crown Prince of Germany took an hour's trip through one of the large sewers. Mr. Hering was generally escorted by the Chief Engineers or the assistants, who think nothing of a walk through their sewers, because, as far as the odor is concerned, there is little or no more difference than in going into a common cellar.

The cost of city drainage averages about the same as with us. The expense of a regular inspection, cleaning and repairing is little greater than what we pay for repairs alone. Of course the price of labor is somewhat less, but the municipal engineers, however, are better paid, as a rule, than in the United States. All appointments are permanent; the best fitted are generally selected for office, and pensions await any disabled servants of the corps, from the chief down.

After alluding to the room for improvement in the sewerage of American cities by utilizing the experience gained by so many other large cities, Mr. Hering gave a brief description of the methods for purifying the sewage before it is discharged into the rivers.

Manufacturing Notes.

The Knowles Steam Pump Works, of this city and Boston, are building two sets of large pumping machinery for the Omaha water works, and for Joliet, Ill.

The Rollstone Machine Company, of Fitchburg, Mass., have, in the last month, filled large orders in twenty or more cities. Among special orders for the month of May, were fourteen machines to one firm in England.

The Hazard Manufacturing Company, of Wilkesbarre, Pa., are making a mammoth wire rope, which, when completed, will measure one mile in length and weight 24 tons. The rope is for use on the Philadelphia & Reading Company's planes at Gordon, Pa.

The Geo. F. Blake Manufacturing Co., of this city and Boston, are building a 6,000,000-gallon compound condensing pump for the New Orleans Sanitary Association; a 2,500,000 gallon pump for Charleston, S. C., and have a good quantity of other large work on the floors of their shops.

The Babcock & Wilcox Company, of this city, manufacturers of water tube steam boilers, recently furnished the Joliet (Illinois) water works a 100 horse-power boiler; the Flint & P. M. R. R. a 500 horse-power for their new shops located at East Saginaw, Mich.; and a 400 horse-power to Whitely, Fassler & Kelly, of Springfield, Ohio.

The Baldwin Locomotive Works, of Philadelphia, have at present sufficient capacity to turn out ten locomotives per week. They turned out their 1,000th locomotive in 1861; their 2,000th in 1869; their 3,000th in 1872; their 4,000th in 1876; and their 5,000th in 1880. The works cover 9 acres of ground in the heart of the city, and when running to their full capacity give employment to 3,000 men.

The New England Gauge Company, of Boston, Mass., have commenced to manufacture a locomotive gauge cock which is now being tested on some of the railroads running out of Boston. It is giving perfect satisfaction. The principle of the Fairbairn patent is something that is appreciated by engineers, and no doubt this gauge cock will come into general use on locomotives as well on stationary boilers.

The Cope & Maxwell Company, of Hamilton, Ohio, are making a pumping engine with a capacity for 3,000,000 gallons per day, for Messrs. Frick & Co., who are preparing to lay four miles of 12-inch cast-iron pipe to convey water from the Youghiogheny river at Bradford, Pa., for supplying their coke works. The water will be pumped into a reservoir on a high hill, whence it will run by gravitation to the desired points.

The Tanite Company, of Stroudsburg, Pa., having their new extension (32x24 feet) now well advanced, find that, in addition to the ultimate completion of that structure according to the original design of four stories (64x28 feet), they will still not have sufficient room. They are, therefore, commencing another large building, 70x30 feet, which, when completed, will have the effect of doubling their present emery-wheel making capacity.

New Publications.

Die "Gute alte Zeit" in Pennsylvanien. Von W. J. Mann, D.D. Philadelphia: Verlag von Ig. Kohler. 1880. ("The Good Old Time in Pennsylvania," etc.)

This little *brochure* is an extremely interesting sketch of the early settlement and history of what is now the State of Pennsylvania, from the pen of a well-known Lutheran clergyman of Philadelphia. It tells the story of the hardships and dangers encountered and suffered by the early colonists, in their contests with savage nature and savage men. It gives an account of the character, nationality, etc., of the early settlers, and of their mode of life; the government and politics of the infant State; the religious life of the people; the history of Church and school; and of other important factors that have contributed to the present development of the second State in the Union.

The work is comprised within the limits of a duodecimo volume of 106 pages, and is well printed and substantially bound. We know of no similar work, covering the same ground, in the English language, and confined to such modest limits, as this. The American student who wishes to refer to the early history of Pennsylvania, must possess himself of the more compendious and elaborate work of Watson, or the histories of the several counties. We should say that the publisher would be doing good service to hosts of English readers by issuing an English edition of Dr. Mann's volume, which, we are satisfied, would find a ready sale and warm appreciation.

The Metal-Work Shop-Card. No. 2. Price, 30 cents, postpaid. David Williams, Publisher, 83 Reade street, New York.

We have received from the publisher of the *Metal-Worker* a specimen copy of a series of cards which contain in tabular form much information of a useful character to workers in metals and others, and which is generally of that kind which is inconvenient to find when wanted. Shop-Card No. 2 has been prepared for the special benefit of tinners, roofers and builders generally. It contains a set of tables for the calculation of tin roofing, and other related matters. It gives, in form convenient for reference, the cost of tin per square of roofing with plates at different prices per box, ranging from $4 to $30, for both flat seam and standing seam. Tables of the numbers and weights of sheet zinc; of the weight of sheet copper, light gauges; of the size and number of sheets per box, and weight of tin and terne plates corresponding to the various commercial gauge marks; and of the number of slates required to cover one square of roofing when laid with 3-inch lap. The card will be found very useful for reference by those for whom it has been prepared.

The Diet Cure. The Relations of Food and Drink to Health, Disease and Cure. By T. L. Nichols, M.D., editor of the London *Herald of Health*. New York: M. L. Holbrook.

The titles of the twenty-four chapters of this work are: Health; Food; Water; Blood; the Natural Food of Man; Disease; Prevention and Cure; the Question of Quantity; the Question of Quality; Principles of the Diet Cure; Medical Opinions on the Diet Cure; of Diet in Acute, Scrofulous and Nervous Diseases; the Diet Cure in Obesity; Vis Medicatrix Naturæ; the Diet Cure in Various Diseases; the Water Cure; Waste of Life; the Life of the Race; the Population Question; Some Practical Illustrations; Air and Exercise; of Psychic Force; National Health and Wealth; Personal Advice.

There have been, from Hippocrates to Dr. Gall, many sensible physicians, and some of the best of them are quoted in "The Diet Cure," which teaches that pure food makes pure blood, and pure blood builds up a healthy body. This book is handsomely printed, bound in cloth, and will be sent by mail for fifty cents.

Report on the Culture of the Sugar Beet and the Manufacture of Sugar therefrom, in France and the United States. Prepared, under the Direction of Hon. Wm. G. Le Duc, Commissioner of Agriculture, by Wm. McMurtrie, Ph.D. Washington: Government Print. 1880.

In view of the growing interest manifested, in various parts of the country, in the possibility of domesticating the manufacture of sugar from the beet, the preparation of a complete compendium of the history of the sugar beet industry in all its bearings, for the use of agriculturists, intending manufacturers and others interested in this important subject, by the Department of Agriculture, is a very thoughtful and timely anticipation of a public want. The present work by the competent chemist of the department is a very complete book of reference respecting the culture of the sugar beet and the processes of manufacturing sugar therefrom, and is very creditable both to the author and the department.

Reminiscences of Dr. Spurzheim and George Combe; and a Review of the Science of Phrenology, from the Period of its Discovery by Dr. Gall, etc. By Nahum Capen, LL.D. New York: Fowler & Wells. 1881.

This work, as its title indicates, is a collection of the correspondence and other literary remains of the three noted apostles of phrenology—Gall, Spurzheim and Combe. Besides being an interesting biographical sketch of these distinguished men, Mr. Capen's work gives an excellent *resumé* of the progress of phrenology from the times of its founders to the year 1840. Those who are interested in this subject, will find the work very readable and historically valuable.

Plans, Specifications and Builder's Estimates for an Improved Bible-School Building and Church Combined. Designed by W. H. Brearley. Detroit, Mich.

These plans have some peculiar and original features, that appear to adapt them very well to the special requirements which Mr. Brearley has endeavored to meet. Builders and others interested in this line may find it useful to communicate with him.

Gems of Art. No. 1. The Gin Shop. Illustrated by George Cruikshank. New York: M. J. Stockwell, 25 Ann street.

This little work is the first of a series to be issued by Mr. Stockwell. The illustrations by Cruikshank are drawn in the effective manner characteristic of that celebrated artist, and the book deserves a large sale. The price is only 10 cents.

OTHER PUBLICATIONS RECEIVED.

Transactions of the American Society of Civil Engineers. January and February, 1881. From the Society.

Report of the Committee appointed to publicly investigate into the alleged Abuses of the Insane Asylum and Almshouse at Blackwoodtown, Camden Co., N. J. From B. W. Pierce.

Tenth Census of the United States. Preliminary Report upon the Iron and Steel Industries of the United States, in the census year 1880, ended May 31, 1880. By James M. Swank, Special Agent of the Census Office. (By permission of the Superintendent of the Census). Philadelphia: American Iron and Steel Association. 1881. From the Author.

Proceedings of the Annual Meeting of the American Institute of Mining Engineers, held in Philadelphia, February, 1881. Advance sheets of numerous papers read before the above meeting. From the Institute.

On the Ratio of Expansion at Maximum Efficiency. By Robert H. Thurston. Reprinted from the Journal of the Franklin Institute for May, 1881.

On the Geology of Florida. With a plate. By Eugene A. Smith. Reprinted from the American Journal of Science for April, 1881.

The Iron Region of Central New York. By Albert H. Chester, Ph.D., Professor of Chemistry and Metallurgy of Hamilton College. An address delivered before the Utica Mercantile and Manufacturing Association. Utica, N. Y. 1881.

Second Catalogue of the American Society of Mechanical Engineers. Organized April 7th, 1880. Officers, members and rules. January, 1881.

Communication to the Sinking Fund Commissioners, city of New York, in reference to the application of John E. Walsh, to build (under contract with the Department of Docks) five hundred feet or more of Bulkhead or River Wall.

Summary Statement of the Imports and Exports of the United States, for the month ended March 31, 1881, and for the nine months ended the same, compared with the corresponding periods of 1880. Prepared and published by the United States Bureau of Statistics. [Corrected to May 12, 1881].

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2835) Photo-Engraving.—Please describe in "Notes and Queries" the process of making photo-engravings.—A. O. S., Galt, Ont., Canada.

(2836) Application of the Sand Blast.—I am informed that the sand blast apparatus is in use for the purpose of giving the satin finish to silver goods. Can you inform me if this is the case, and if so, where I could ascertain something about its success?—P. T., Toledo, Ohio.

(2837) The Earth-Eating Habit.—I have several times come across articles in the newspapers referring to "dirt-eating" among a degraded class of people in North Carolina and other Southern States, as though it were a wide-spread habit. Is it true that such a habit is practiced to any extent?—J. L. McC., Montpelier, Vt.

(2838) Glass for Water Pipes, etc.—Why could not the common varieties of colored glass be used for water pipes, drain pipes, and similar uses?—C. McA., Louisville, Ky.

(2839) Platinum and Aluminum.—Have the metals platinum and aluminum ever been used for coining into money? If not, will you please state if there is any special reason why—that is, any objection, and oblige.—J. H. W., Jacksonville, Fla.

(2840) Cold-Punched Nuts.—Was there not a controversy some time since between the makers of cold-punched nuts and hot-pressed nuts? My recollection is that there was a competitive trial of the two. If so, can you refer me to the record of those tests?—G. F. B., Jr., Allentown, Pa.

(2841) Trouble with a Refrigerator.—I have a new refrigerator which gives to all the food I put in it a woody taste. Can you inform me what I can use to obviate this, and oblige. —A Housekeeper, Brooklyn, (E. D.,) N. Y.

(2842) Heating Power of Various Combustibles.—Are there any tables published giving the heating powers of different combustible substances, or fuels?—C. F. H., Akron, Ohio.

(2843) Outside Water-Closets.—I am thinking of building six twin cottage houses in English style, and wish to know if it is practicable, by laying down a terra-cotta pipe to a culvert on my side street, to have what is called dry closets, or similar water-closets to those in use in our houses in connection with bath-rooms? I feel afraid that in winter the pipes will burst, and so prevent me adopting the plan. Is there any way of overcoming the difficulty? An answer will oblige.—R. M., Philadelphia.

(2844) Oil-Proofing Paper Barrels.—Can you inform me what I can use on the inside of paper barrels to make them oil-proof?—J. P. N., Cleveland, O.

(2845) Rough-Cast on Brick.—I have several brick outbuildings that I think of having rough-cast, but am afraid it will not stand well on outside work. What is the best plan to follow to prevent such plaster coat from scaling loose and falling off?—B. F. B., New Britain, Pa.

(2846) To Make a Clear Caoutchouc Solution.—Will you please give me a recipe for making a clear caoutchouc solution. —J. W., Montgomery, Ala.

(2847) Velocity and Pressure of Wind.—Can you give me a table showing the pressure exerted by the wind at different velocities, or a rule by which to find it?—G. F. L., Salem, N. J.

(2848) Sand Blast Apparatus.—Some time since I wrote to find out of you could refer me to any description of a simple contrivance for utilizing the sand blast for marking reagent bottles. I saw one in the laboratory of Cornell University which consisted of a box 12×18 inches holding sand, and having a square hole in the top. The injector was so contrived that when this hole was stopped—that is, by the bottle to be engraved—the sand was thrown violently up against it; and when the object was removed, the sand remained quiet in the box. In this way there was no dust, no waste of sand, and no trouble, since the blast was in operation only so long as an object was placed over the hole so as to exclude the air. If you can tell me how the thing is constructed, you will greatly oblige.—E. A. S., Tuscaloosa, Ala.

(2849) Poor Plaster in a Ceiling.—The garret of my house in the country was lately converted into sleeping-rooms, and there was, unfortunately, a barrel of bad lime mixed with the plaster that was put on the walls and ceiling. The bad plaster shows itself by the number of spots which appear in the ceiling, and which continually peel off and fall upon the bed and the floor. If a piece of plaster thus falling from the ceiling, were to fall in the eye of any one lying on the bed with their face up, would it not be calculated to injure the eye, if not to destroy it entirely. If such an accident were to happen, with any danger attending it, what remedy would you suggest? The plaster has been on since the middle of May.—A Great Admirer, New York City.

REPLIES.

(2813) To Remove Mortar Stains from Brick Fronts.—R. Middleton, of Philadelphia, kindly sends us the following information respecting this query in our May number: "I notice an inquiry by some one in your 'Notes and Queries,' as to what will remove mortar stains from red pressed-brick walls. I answer that in Philadelphia we use muriatic acid largely diluted with water, using, say to a front 16 feet by 3 stories high, 2 pounds. To half a bucket of water put in say 1 pound. Apply with a large coarse sponge. Let a man with a big hand and thick skin apply it, and it will not hurt him. Of course when this is used up, dilute the remaining 1 pound in the same way."

(2835) Photo-Engraving.—The process commonly known as photo-engraving, which is now largely used as a substitute for wood engraving, is substantially as follows: A considerable show of secrecy is maintained by those who practice this art, and there are doubtless many minor details that contribute materially to the success of the operation and the quality of the work, which are jealously guarded. In the following we do not pretend to give more than the general outline of the process; many details will have to be gleaned by actual experience as difficulties arise. The starting point of the photo-engraving process is the peculiar property possessed by gelatine that has been treated with bichromate of potassium. When a film or sheet of such bichromated gelatine that has been prepared in the dark, is exposed to the action of light, the gelatine becomes insoluble in the parts that have been so exposed. If it be immersed in water after such exposure, it will neither dissolve nor swell like ordinary gelatine or glue. If, however, portions of the bichromated film have been protected from the action of the light, such portions will soften, swell and gradually dissolve in water, as usual. If a sheet of bichromated gelatine is exposed to the light under a photographic picture (on glass), the light will only pass through the lights of the picture, but will be stopped by the blacks, and consequently only those portions of the gelatine film where the light passes through will be made insoluble, those portions beneath the blacks remaining unaffected, and retaining therefore their property of swelling in water. In the photo-engraving process, sheets of warmed plate glass are flowed with a thin and even film of chromated gelatine in the dark, and placed aside to cool and dry. With these, a copy of the subject is obtained in relief, in the following manner: A photographic negative of the subject to be copied having been made, one of the chromated gelatine plates is exposed beneath it in an ordinary photographic printing-frame, for about a quarter to a half minute, to the action of the sunlight. The sensitive plate is then at once transferred to a shallow dish of luke-warm water. Those parts of the gelatine film that have not been affected by the light—that is, those that were beneath the dark portions of the negative, shortly begin to swell up, while those that have been affected by the light—that is, those beneath the light parts of the negative, having been rendered insoluble, remain depressed. The plate should be transferred from time to time to fresh water, as the unchanged bichromate of potassium freely dissolves out from the gelatine and passes into the water. If these operations have been properly performed, within a half hour to one or two hours, according to the sensitiveness of the plate and the circumstances of the exposure, the subject will be found in visible relief on the plate. It is then removed from the water, dried off with tissue paper, placed in a suitable frame, and a cast made of it in plaster. The operation of removing the gelatine from the plaster must of course be performed with care. Having now a plaster cast in relief of the subject, it is only necessary to obtain a copy of this in metal, which may be done either by electrotyping, or by making a second plaster cast from the first, and producing a stereotype from that. The latter plan is that usually followed. The stereotype or electrotype is finished and blocked as usual, and is then ready for the printing press. As the object of this process is to obtain a relief plate to be worked in the printing press, it is hardly necessary to add in conclusion that the engraving or drawing to be engraved must be in lines or dots. The subject may be enlarged or reduced at pleasure. Where drawings are made for this process, the lines should be jet black; or if an engraving is to be copied, the print selected for the purpose should be a good impression.

(2836) Application of the Sand Blast.—We have been informed, or have heard the statement made a number of times, that the sand blast is used by some manufacturers for the purpose named by this inquirer—namely, to produce on plated ware or silver the lusterless, finely grained surface, called by the trade satin finish. How generally it is used by manufacturers, or how satisfactory it has proved to be, we cannot say, having no personal knowledge of any particular establishment where it is used. This information our correspondent can obtain without difficulty by addressing a note to Mr. B. C. Tilghman, the inventor of the sand blast as a mechanical agent, at Philadelphia, where he is doubtless sufficiently well known not to require a more definite address [care of the Franklin Institute would be sure to reach him]. The only special information we find respecting the use of the sand blast for this purpose, is a brief account of its adoption about five or six years ago by a Connecticut manufacturing firm (name not given). Their method of operation was described to be as follows: A quantity of air is compressed by the driving engine of the works into a suitable reservoir provided for the purpose, from which it is distributed through pipes which extend along the front of the workmen's tables. Above the table is a V-shaped sand receptacle, from which a stream of sand falls, and is met by a downward blast from the air pipe, which impels the sand with considerable force through a small hole in the table, beneath which is a close chamber to receive the sand. The workman, whose hands are protected by a pair of rubber gloves, holds the article in the sand jet and beneath the table, watching it through a pane of glass let into the top of the table. The operation is asserted to be exceedingly rapid, the article simply requiring to be turned rapidly in the jet, so that the blast shall strike the required portions, when the work is completed. The rapidity of the operation can of course be controlled by regulating the intensity of the blast. Those portions of the ware that are not required to be abraded, are protected from the action of the sand by coverings of sheet rubber of suitable pattern, on which the sand has no cutting action. By the use of such screens, the most fanciful designs can be imprinted on the exposed silver surface. The spaces protected by the rubber patterns are afterwards burnished.

(2837) The Earth-Eating Habit.—It is a matter of common knowledge that in certain parts of the Southern States many of the class who are contemptuously designated as "poor whites," habitually eat a certain kind of blue earth (or clay), and, in some cases, in such large quantities that the abdomen is permanently distended, and a sallow and unhealthy appearance is imparted to the complexion. Those who are addicted to the habit, which, when once acquired, becomes a necessity like every other habit, may be recognized sometimes by their appearance, and are called "dirt-eaters." It is not so difficult to account for the earth-eating habit as it would seem at first thought, and it is by no means confined to the class above named; on the contrary, it is a common practice among many widely separated peoples. The earths that are eaten, are invariably such as are smooth and unctuous to the taste, and therefore not unpleasant. They all probably contain a certain though trifling amount of soluble mineral substances, which may be regarded as nourishing, for we are all obliged to take a certain quantity of these same substances in other forms in our food, for the proper nourishment of the body. They are absolutely necessary for the building up and maintenance of the bones. The earth-eating habit, therefore, though in the case of the North Carolina "dirt-eaters" it may be simply the gratification of a depraved or vitiated appetite, may in many other cases where it is practiced, be one of the natural consequences of the demand of the system for mineral nutriment. We find, for example, that the practice is very general among the native inhabitants of tropical countries who subsist largely on sweet and watery fruits, and in these cases we may reasonably infer that the dearth of mineral matter in this species of food creates the craving for it, which is sought to be gratified in the most natural manner by eating the smooth, greasy clays and other earths which are everywhere abundant, and not offensive to take by those who are not squeamish. In other cases, sheer necessity—as, for instance, a general famine—has driven people to satisfy the cravings of hunger with these filling but not satisfying substitutes for food. In other cases, there is no doubt that the habit is simply the gratification of a depraved taste. We believe this to be true of the Carolina "dirt-eaters." It is certainly true of the Swedish peasants, the Finns, and the Laplanders, some of whom are known to actually add a certain very fine unctuous infusorial earth to their meal in preparing their bread. The quarrymen in some parts of Würtemberg are known to eat with relish a smooth, greasy clay that they sometimes find in the crevices of the rocks, and which they call *Mondschmalz* (moon grease). In Thüringen, a province of North Germany, the quarrymen eat a similar substance, which they call *Steinbutter* (rock butter), spreading it on their bread. Travelers report the earth-eating habit to be very common among the native tribes inhabiting the shores of the Amazon, the Attomacks in Guiana, the natives of Martinique and Guadaloupe, and the Javanese. Among the last named people, the earth is formed into thin cakes having a diameter of about one to two inches, dried over an open fire, and exposed for sale as an article of food. This particular earth was examined by Prof. Fuchs, who found it to be a clay rich in iron, perfectly smooth to the touch, and without the slightest grittiness to the taste. The edible earth of the Amazon tribes is said to be an infusorial earth; and that of other South American tribes, a clay. In the province of Parana, the native women prepare shallow cups as thin as cardboard from a species of clay having an agreeable odor. These they use for drinking-cups, the clay imparting to the water an agreeable taste. After drinking, the cup is eaten. A similar custom prevails among the Chili Indians; while in Portugal, in the province of Estramos, a simi-

lar clay is made into lozenges, which are esteemed by the ladies as a great delicacy. Berzelius, the noted Swedish chemist, is authority for the statement that the peasantry of his country were accustomed to consume hundreds of wagon loads of the famous deposit of infusorial earth at Lüneburg, not from any dearth of nourishing food, but from choice. The same habit has been previously noticed of the Finns and Laplanders. Finally, we may add, that enormous quantities of earth are annually and unknowingly consumed in every portion of the United States (and most probably in all portions of the civilized world), under the tempting guise of candies and confections, as it is an open secret that our confectioners are very generally given to the practice of using the cheap *terra alba* and gypsum as a convenient make-weight and adulterant of their sugar.

(2838) Glass for Water Pipes, etc.—We know of no valid objection to the use of the cheaper grades of glass for the purposes named by this correspondent, and for many others where iron or terra-cotta are at present generally used. In fact, we think that glass in many respects is greatly superior to either of the above named materials for these uses, and especially for water conduits. Glass in the form of tubes will compare very favorably in strength with cast iron, and is much stronger than terra-cotta. It is absolutely impervious to moisture, and almost completely proof against corrosion or chemical action, to which iron is notoriously susceptible, and to which even glazed terra-cotta is not wholly indifferent. The suggestion to use a substance like glass, which is commonly associated with the quality of brittleness, for purposes where considerable strength is required, seems at first like going contrary to common experience. But this anomaly is apparent rather than real, for although glass is very friable in the form of thin sheets or vessels with thin shells, it loses its brittleness when in massive form, and in this condition is really surprisingly strong. A practical proof of this is seen in the very general use of glass for paving and flooring. On this point some figures from Trautwine may be interesting. He gives the tensile strength of glass at from 2,500 to 9,000 pounds per square inch, according to kind; crushing strength, 6,000 to 10,000 pounds per square inch; transversely, by his own trials, Millville (N. J.) flooring glass, one inch square, and one foot between the end supports, breaks under a center load of about 170 pounds, consequently it is considerably stronger than granite, except as regards crushing, in which the two are about equal. When we consider the many admirable qualities that glass possesses, we confess to something like surprise that it has not long ago found its way into very general use for an immense number of applications where other and much inferior materials are still exclusively employed; and we do not question but that the time is near at hand when we shall find it supplanting other materials very generally for the particular uses to which our inquirer refers, and for many others. There can be no objection to its general use on the score of cost, as it may be produced more cheaply than cast iron; and, by the utilization of blast furnace slag, it could be made even cheaper. It is already considerably in use for flooring, and it has lately been successfully experimented with for railway sleepers under exceptionally severe conditions. We believe that in the near future the applications of glass will be very widely extended.

(2839) Platinum and Aluminum.—Replying to this correspondent, we will say that platinum was quite largely employed by the Russian government at one time as a circulating medium; but its use for this purpose has been abandoned for some time. There may still be some of the old issue of platinum coins in circulation in Russia. The chief objection to platinum as a circulating medium, is the difficulty experienced in working it, otherwise it appears to be well adapted for the purpose. It is very heavy, its specific gravity being superior even to that of gold, and this property would render the detection of counterfeits even more easy than with gold. It is fully equal to gold in its indifference to the action of the atmosphere and chemical agents, and surpasses it in hardness and wearing qualities. Finally, the cost of its production has remained tolerably constant for a number of years, and bids fair to remain so. There are, therefore, many reasons to recommend platinum for use in coinage, but gold has steadily maintained its popularity among all nations for the coinage of the more valuable pieces of money; and the uniformity of its supply, the ease with which it can be worked, and its other desirable qualities, promise to maintain its popularity. Aluminum, so far as we know, has never been used by any nation for coinage into money. It has often been recommended for this purpose, and the mints and museums in various countries are well provided with admirable samples of medallions and experimental coins that have been made of this metal. It has a number of admirable qualities for this purpose, the chief of which are its extreme lightness, which is as excellent a safeguard against counterfeiting as the extreme weight of gold or platinum; its indifference to many chemical agents and to atmospheric exposure, and its hardness and good wearing qualities. The chief objection to it appears to be the want of security against its great depreciation in value. Thus far its value has remained tolerably constant at about one-half to two-thirds that of silver for a number of years; but it is just as likely as not that tomorrow may bring us the announcement of the discovery of some cheap method of producing this metal.

(2840) Cold-Punched Nuts.—There was such a controversy between one of the representative makers of the ordinary hot-pressed nuts and the makers of cold-punched nuts, the production of which last is confined to a single firm. These rival claims to excellence, which came into conflict at the Centennial Exhibition, resulted in a challenge to a competitive trial. Prof. Thurston, of Hoboken, N. J., was selected as the expert to make the tests, which were conducted in the mechanical laboratory of the Stevens Institute. A bar of iron was provided by the expert, cut in two, and nuts made from each half in his presence by the rival makers. These were then subjected to a test of strength by stripping and bursting stress. The results were very favorable to the nuts made by cold punching. They showed greater average strength combined with greater rigidity, and slightly greater uniformity, than the hot-pressed nuts; and these qualities were especially manifested in the trials by stripping stress. The maximum strength of the cold-punched nuts also was considerably greater than that exhibited by those made by the usual process. The facts respecting these trial tests attracted much attention at the time by reason of their importance and the publicity given to the circumstances, and the details were very generally published in the technical papers. By addressing Prof. R. H. Thurston, Stevens Institute, Hoboken, N. J., or Messrs. Hoopes & Townsend, Broad and Buttonwood streets, Philadelphia, our inquirer will have no difficulty in obtaining a copy of the published report of the tests above referred to.

(2841) Trouble with a Refrigerator.—The trouble named by this correspondent is a very common cause of complaint, and is not easy to remedy. Unless the wood of which such a receptacle is made has been perfectly seasoned, it will continue for some time to give out certain volatile elements peculiar to it, which in a closed chamber will be very perceptible to the smell. It will correct itself in time, and this may be hastened by frequent scalding with boiling water and airing. A more rapid and effectual method would probably be to scrub the exposed wood-work of the interior of the refrigerator with hot water containing a small quantity—say about one or two per cent—of chloride of zinc. This material can be procured in liquid form at any drug store, or can be easily made at home by covering some scraps of zinc in a glass bottle with a little diluted muriatic acid, and letting it remain for a day, or until all signs of effervescence have ceased. A few applications of this remedy, we think, will banish the trouble.

(2842) Heating Power of Various Combustibles.—This correspondent will find tables of the heating powers of various combustibles published in all the more extensive works on heat and steam engineering. We give below, for his use, one of the best of these, embracing the experimental results of MM. Favre and Silbermann:

Combustibles.	Quantity of air consumed per pound of combustible.		Total heat of combustion of 1 lb. of combustible.	Equiv. evaporative power of 1 lb. combustible at 212° Fah.
One pound weight.	lbs.	cub. ft.	heat units.	lbs. water at 212°.
Hydrogen	34.8	457	62,032	64.20
Carbon—making carbon oxide	5.8	76	4,452	4.61
Carbon—making carbonic acid	11.6	152	14,500	15.0
Graphite	11.6	152	14,040	14.53
Carbonic oxide	2.48	33	4,325	4.48
Light carb. hydrogen	17.4	229	23,513	24.34
Olefiant gas	15.	196	21,343	22.09
Sulphuric ether	11.3	149	16,249	16.82
Alcohol	12.1	159	12,929	13.38
Turpentine	14.3	188	19,534	20.22
Sulphur	4.35	57.	4,032	4.17
Wax	14.1	185	18,893	19.56
Olive oil	13.2	173	18,796	19.46
Tallow	12.83	169	18,028	18.66
Coal of average comp.	10.7	141	14,133	14.62
Coke, thoroughly dried	10.9	143	13,550	14.02
Wood, do	6.1	80	7,792	8.07
Wood charcoal, do	9.8	129	13,309	13.13
Peat, do	7.6	100	9,951	10.30
Peat charcoal, do	9.9	129	12,325	12.76

(2843) Outside Water-Closets.—This inquirer evidently proposes to erect water-closets in connection with the back buildings of his houses, to take the place of the common privy-well. The term "dry closet" which he uses in this connection is misleading, as this term can only be applied correctly to dry earth-closets, and similar contrivances. The situation in which he intends to place these closets would largely determine whether there would be much danger of pipes freezing. In many cases at present the plan is followed of providing a water-closet in the cellar, in addition to that usually provided in or adjoining the bath-room. The former is designed for the use of the domestics employed in the house, and the latter for members of the family. An arrangement of this kind would do away with the unsightly outhouse, and would be safe against the liability of the pipes freezing. If the closets are located on the ground floor, the drain pipe should be placed at least 4 feet 6 inches beneath the surface to prevent freezing.

(2844) Oil-Proofing Paper Barrels.—It will doubtless be difficult to find a better substance than glue for the purpose of making paper barrels resistant of petroleum oil, since it not only answers the purpose very effectually, but is cheap. At the present writing we do not think of any material that would be an improvement. Naturally the gums and resins suggest themselves for the purpose, but unfortunately all of these substances are more or less soluble in petroleum, and hence are useless for the purpose. There is one hint, however, that we will throw out, that our inquirer may perhaps see his way clear to utilize, though this will depend very much on the process by which his paper barrels are made. It is well known that paper, or paper pulp, treated with chloride of zinc (or sulphuric acid), under proper conditions, then washed to remove the excess of the chemical agent employed, and subjected to great pressure, is converted into an exceedingly hard, tough and strong material, quite impervious to liquids. By consulting any of the standard works on chemical technology, our correspondent will be able to obtain the details of the operation, and will be able to judge if it would be applicable to his case.

(2845) Rough-Cast on Brick.—When properly put on, a rough-cast coat on brick stands very well. We give this inquirer the following hints: In brick walls intended to be plastered, the mortar joints should be left very rough, to let the plaster adhere. If it is put on smooth walls without first raking out the mortar to the depth of nearly an inch, it is very apt to fall off, especially from outside walls where it is exposed to the extremes of heat and cold, dryness and dampness. Where brick walls are intended to be rough-cast, the bricklayer should be instructed not to fill out the mortar joints flush, but to leave proper recesses between the brick courses. This avoids the necessity of raking out the joints, which is tedious and expensive. In the case named by this inquirer, we have not been furnished with particulars, and therefore cannot venture to say whether it would be better to plaster or to use paint. We might add in conclusion the hint, that before plastering, the walls should be carefully freed from dust and slightly dampened as the plaster is put on.

(2846) To Make a Clear Caoutchouc Solution.—Perhaps the following recipe will be of service to this inquirer: Prepare a capacious linen bag, in which place about an ounce of finely chipped caoutchouc. Suspend this by a thread in a flask containing about a quart of benzine, in such a manner that the linen bag is held near the surface of the liquid. The soluble portion of the gum—about 40 to 60 percent—will be dissolved out in the course of about a week, and will pass into the benzine, forming a clear, limpid, but viscous liquid, containing about 1½ per cent of caoutchouc. The linen bag with its contents, now enormously swollen, should then be withdrawn and the clear liquid poured off into a suitable bottle tightly stoppered, and kept in the dark, as it shows a tendency to decompose on exposure to the light. The swelled contents of the bag containing the residue of the gum may be utilized for the preparation of an inferior grade of caoutchouc cement or varnish, by the addition of more benzine.

(2847) Velocity and Pressure of Wind.—The relation between the velocity of the wind and the pressure it exerts upon any surface opposed to it, varies according as the surface is at right angles to its course or inclined to it, or as the surface is curved or flat. The rule generally followed for surfaces at right angles to the direction of the wind, is to consider the pressure in pounds per square foot of exposed surface to be equal to the square of the velocity in miles, divided by 200. By this rule, the following table by Smeaton, has been prepared:

Vel. in miles per hour.	*Vel. in ft. per second.*	*Press. in lbs. per sq. ft.*	*Remarks.*
1	1.467	.005	Hardly perceptible.
2	2.933	.020	Pleasant.
3	4.400	.045	
4	5.867	.080	
5	7.33	.125	
10	14.67	.5	
12½	18.33	.781	Fresh breeze.
15	22.	1.125	
20	29.33	2.	
25	36.67	3.125	Brisk wind.
30	44.	4.5	Strong wind.
40	58.67	8.	High wind.
50	73.33	12.5	Storm.
60	88.	18.	Violent storm.
80	117.3	32.	Hurricane.
100	146.7	50.	Violent hurricane, uprooting large trees.

(2848) Sand Blast Apparatus.—We have not been able thus far to obtain for this correspondent the description of the apparatus he inquires about. Should we be able to do so, we will be pleased to give him the desired information. As the various mechanical applications of the sand blast are protected by patent or patents, it is not probable that this special apparatus could be used properly without arrangement with the owners of the patent right. We therefore refer E. A. S., as we have another correspondent in this department, to the inventor, whose name and address are given in reply to Query 2836.

(2849) Poor Plaster in a Ceiling.—The lime in the superficial layers of plaster that scale and drop off from this inquirer's ceiling, has no doubt lost its caustic quality by absorption of atmospheric carbonic acid, and there need be no fears on his part of the eye being seriously injured or destroyed should a flake in dropping fall into it. Of course the eye, being a delicate and sensitive organ, is very painfully irritated by any foreign substance that accidentally enters it, and would be so also in this case. But we apprehend that nothing more serious would happen in this event than would result from getting flying cinders or dust in the eye.

THE MANUFACTURER AND BUILDER.

Vol. XIII.—No. 8. AUGUST, 1881. THIRTEENTH YEAR.

The Hancock Inspirator.

This instrument, which has acquired a well-deserved reputation as a very efficient device for feeding boilers, and has come into very extensive use for that purpose, differs in certain important respects from the instruments commonly classed under the head of injectors. It differs from the common injector in being a double instrument, one half of which is a lifting and the other half a forcing apparatus; the lifter drawing the water from a well or tank and delivering it to the forcer, which in turn delivers it to the boiler, and at any steam pressure, without adjustment. It consists of a lifting jet and lifting nozzle combined with a forcing jet and force nozzle, or injector; and when the apparatus is in operation, steam is admitted to both of these

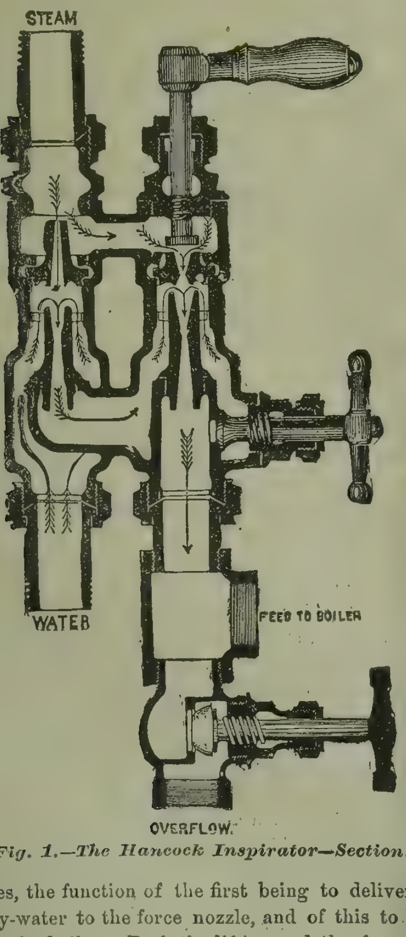


Fig. 1.—The Hancock Inspirator—Section.

nozzles, the function of the first being to deliver the supply-water to the force nozzle, and of this to force it into the boiler. Both the lifting and the force nozzles are fixed, and their proportion, one to the other, is such that the instrument requires no adjustment for changes in steam pressure or water supply, the waste valve being kept closed while the instrument is in operation, except at the time of starting.

Two forms of inspirators are made; the one illustrated in Figs. 1 and 2, in sectional and exterior views, is that recommended for stationary boilers. The steam connection with the boiler is made at the end so marked in the cuts, and its course through the instrument is indicated by the direction of the arrows. The left-hand side of the instrument, as the cuts are seen, is the lifting side, and the other the forcing side. The steam current divides in the upper chamber; a portion passing down through the vertical nozzle operates the lifting nozzle, seen about the center of the lifting side of the inspirator, the water ascending around and passing down through the connecting tube, as shown, into the forcing side of the instrument, where it is delivered through the forcing nozzle and communicating chamber into the boiler through suitable connections provided for the purpose. The valve marked 2 at the top of the forcing side of the inspirator, controls the entrance of steam through the forcing nozzle. Another valve, marked 1, provided in the lower portion of the forcing side of the instrument, determines the course the water is to take when delivered into the water chamber by the action of the lifting jet. This valve is to be opened when starting the instrument, and closed as soon as the action of the jet is established. To regulate the delivery of the water to the boiler, it is only necessary to regulate the valve in the pipe

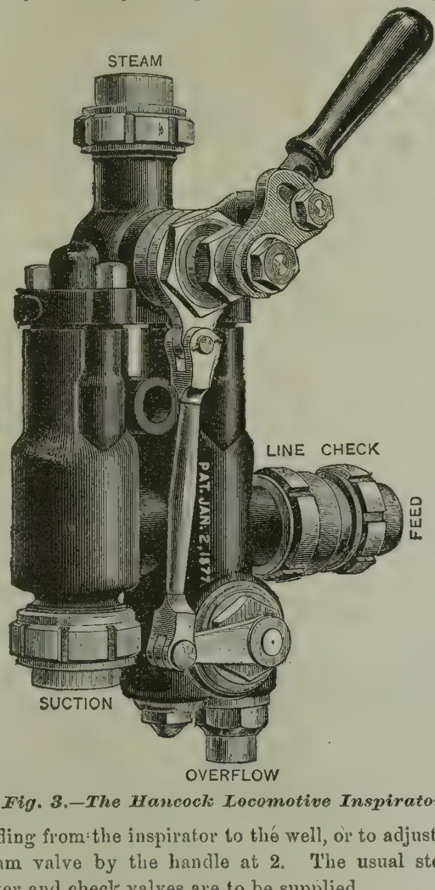


Fig. 3.—The Hancock Locomotive Inspirator.

leading from the inspirator to the well, or to adjust the steam valve by the handle at 2. The usual steam, water and check valves are to be supplied.

The apparatus here described is adapted for feeding water to steam boilers, for filling tanks, and for any and all purposes for which a pump may be used for moving water. Its parts are all fixed, and it is consequently not liable to derangement, and is very durable. As has already been pointed out, the inspirator differs from the ordinary injector in being a double apparatus, this form of construction giving it the advantage over the injector of delivering its water at any steam pressure without adjustment. With 45 pounds steam pressure, the inspirator will lift water from 90° to 100° Fah. 25 feet and deliver it into tanks or to the boiler. It will take water at 140° Fah. on a lift of 3 4 feet, or under a head, delivering it in either case at a temperature nearly 100° higher. The essential conditions for the successful operation of the inspirator are stated by the makers as follows: 1. A tight suction. The inspirator raises the water by creating a vacuum, which cannot of course be obtained without having the suction pipe and connections absolutely air-tight. 2. Steam should be taken direct from the boiler, tapping it so as to secure dry steam. This condition is very important for a number of reasons. Where steam pipes are already connected with the boiler, it is for some purpose, and they are not likely to be of sufficient capacity to supply the inspirator, and do the work for which they were originally designed. Again, the connection may be at a considerable distance from the boiler, so that the steam in the pipe is mere vapor,

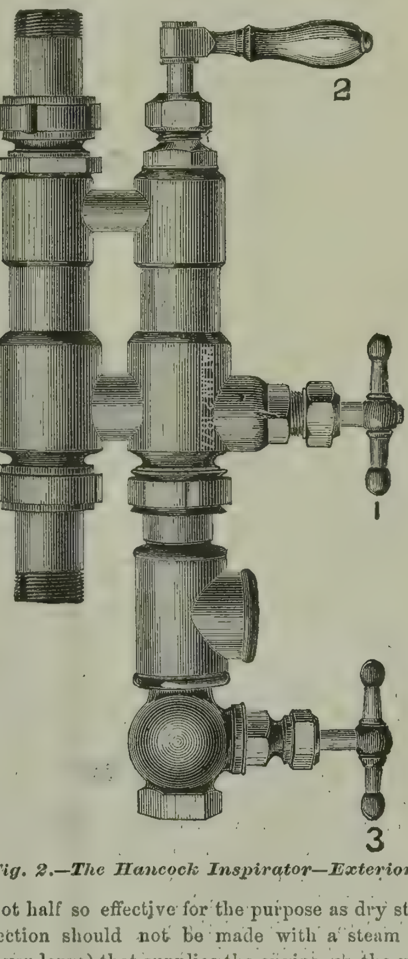


Fig. 2.—The Hancock Inspirator—Exterior.

and not half so effective for the purpose as dry steam. Connection should not be made with a steam pipe (however large) that supplies the engine, as the pressure will be so irregular and intermittent as to seriously interfere with the successful working of the inspirator. The boiler should be tapped where the dryest steam can be obtained; if obliged to connect with a large steam pipe, it should be tapped on the upper side, so as to avoid the drip caused by condensation in the large pipe, or the steam pipe will be little else than a drain to draw off the condensation in the large pipe. If steam cannot be taken for the inspirator at a higher point on the boiler than the engine supply pipe, or pipe used for conveying steam for any other purpose, the boiler should be tapped for the inspirator at some distance from such pipes.

The makers give the following directions for connect-

ing and operating their instruments, which are so plain that any competent engineer will understand them and be able to regulate his steam and water supply so as to obtain the best results in his particular case: Connect as shown, "Steam," "Water," and "Feed." In making steam connection with the boiler, do not connect with other steam pipes, but take the steam direct by tapping the boiler. Place a globe valve in the steam pipe just above the inspirator, for a starting valve, and a check valve in the feed-pipe between the inspirator and the boiler. Blow out steam pipes before connecting. For a high lift, or a long draught, make the suction one size larger than the connections. Be sure that the suction connections are perfectly air-tight. For a lift of 5 feet, about 15 pounds steam pressure is required; for 10 feet lift, about 20 pounds steam; for 15 feet, 25 pounds; for 20 feet, 35 pounds; for 25 feet, 45 pounds. Every machine is carefully tested before leaving the factory, and is warranted to work satisfactorily if the directions for connecting are strictly followed.

The makers also manufacture a special form of inspirator for locomotive use, which is shown in Fig. 3 in its latest improved form. The principle of this instrument is the same as that of the stationary apparatus just described, but its arrangement is such that all the operations of starting and stopping are performed by the movement of a single lever. It also contains the necessary steam, check and overflow valves. A slight movement of the starting lever admits steam to the lifting jet. When water issues from the overflow, a further movement of the starting lever closes one of the valves, thus turning the supply-water through the force nozzle, admits steam to the forcing jet and closes the waste valve, thus starting the instrument. In attaching this instrument to a locomotive, it is usual to place a "lazy cock" in the supply pipe, by means of which the engineer can control the water supply without changing the position of the starting lever.

The Hancock inspirator has demonstrated itself to be one of the most efficient instruments of its kind that has yet been devised.

There are, we are informed, about 20,000 of these inspirators in use in this country and in Europe. They have been adopted by a large number of steamship lines, and they are exclusively in use for boiler feeding in many of the largest mills and manufacturing establishments throughout New England. They have also been adopted by a number of the portable and farm engine and boiler manufacturers in this country and in England, in place of the usual pumps. The seven iron excursion steamboats lately completed for New York pleasure travel, are all fitted with this instrument. The makers guarantee every instrument to be in perfect condition. While not admitting that there is any advantage in using very hot feed-water, they claim that the inspirator is competent to handle as hot water as any other similar apparatus. We have their authority for the statement that they have a number of inspirators at work taking water at 150° Fah. and over, and delivering it to boilers at 225° to 260° F. They employ a competent engineer for the special work of visiting mills and factories throughout New England to superintend the proper selection and attachment of their inspirators, at no expense to the mills.

The manufacturers of these inspirators are the Hancock Inspirator Co., 34 Beach street, Boston, Mass.

PAPER BELTING.—At the exhibition now being held in Japan, an interesting feature is the successful use in the machinery hall of paper belting. The Japanese have long been celebrated for their manufacture of some exceedingly tough descriptions of paper, and it is stated that the paper belting has been tested and found much stronger than ordinary leather. Now that machinery is rapidly making its way into Japan, the manufacture of this paper belting is of special interest to the country, as from want of proper tanning good leather is not made by the Japanese.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

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The Prospects for Underground Telegraphy.

The persistent and vigorous onslaught on the post and wire nuisance in our cities, that has of late been started and kept up, first by the more intelligent and enterprising portion of the technical press, and finally by the public newspapers, appears at length to be telling. From a number of quarters independently of each other, we have received the encouraging news that experimental underground lines are being put down, that the subject is receiving the earnest attention of the magnates of the wire, and that the telegraph companies even make the admission that "the embarrassments arising from the use of poles for the support of wires running through cities will soon compel a resort to different methods, and that insulated wires laid underground appear to be the most feasible."

These facts indicate a very different state of affairs from that which existed a few months ago, when even an influential portion of the scientific press treated the question of the practicability of underground telegraphy with many ifs and buts and misgivings, or, at best, damned the reform with faint praise. For this gratifying change of heart, the few journals that have stood side by side with the MANUFACTURER AND BUILDER in persistently demanding the suppression of the post and wire nuisance, may, without laying themselves open to the charge of self-laudation, justly claim a large share of credit.

The inertness or stolid indifference of the great companies in respect to this substantial reform, made it absolutely imperative to bring outside pressure to bear to force the unwelcome subject to their consideration. The only effective lever that could bring sufficient pressure to bear to move such a redoutable institution as the telegraphic monopoly, was the lever of public opinion. To educate public opinion to the point of appreciating the enormity of the offence of the companies in imposing upon public ignorance and good nature by maintaining a system that had years ago been discarded, or suppressed as a nuisance, in the cities of Europe, was the task which the pioneers in this reform had set before them to accomplish. The writers for the public press are not good electricians, but so soon as the unanswerable fact was made known to them that underground telegraphy was in universal practice in the cities of Europe, and had been for years, and that even extensive land lines were in successful operation, they took in the situation and vigorously advocated the reform. With such satisfactory results has this advocacy been followed, that we are warranted in hoping that the day that will witness the banishment of the obnoxious posts and wires from our streets and house-tops is near at hand.

Mr. Prescott, at one time Electrician of the Western Union Telegraph Co., and at present president of several telephone companies, admits the fact of the successful practice of underground telegraphy abroad, and that the greater severity of our storms, and the rapid multiplication of wires in American cities, render the question of abandoning the present system one of urgent importance. He is reported as stating: "The more valuable the telegraph and telephone property becomes, the greater will be the damage suffered by storms, and the more urgent the necessity for putting the wires under ground."

From a brief reference to the subject in the *Iron Age*, which we remember a few years ago as one of the doubting Thomases, when we first began to agitate in favor of the reform, it would appear also that the Western Union corporation had at length come to the sensible conclusion that underground telegraphs in our cities could not long be delayed. The article referred to makes the following references on this point, viz: "Dr. Norvin Green, President of the Western Union Co., having been authorized by the Executive Committee to see what better plan could be devised, he reiterates in substance the statements made in these columns within the last month, that various plans have been considered, in which economy is a common factor. Furthermore, the method of insulation most approved,

and upon which current observations in practical working have an important bearing, is essentially an American system. The wires are wrapped in cotton tape saturated with paraffine oil, and then drawn through an iron tube. For more perfect insulation, the tube is filled with oil, fed from a stand-pipe at the highest elevation. A pipe no more than 1¼ inches in diameter has a capacity for 125 copper wires, equal in conducting power to No. 6 iron wire, or 300 wires large enough for the telephone. Mr. Prescott argues that this plan is more economical than the English or German methods of insulating with gutta-percha. The latter has a radical defect in its liability to melt when exposed to the heat of a boiler or furnace, which may often happen; paraffine, on the other hand, whether congealed or heated, would not suffer as a non-conductor. This at present appears to be the main question—paraffine or gutta-percha—but those who are in a position to judge, believe that something definite in regard to the whole matter will soon be reached. Laying the tubes beneath the concrete in Broadway will be very expensive, estimated at $2 a yard; but some other thoroughfare may be chosen for this purpose. In any case, a division of the expense among the telegraph and telephone companies could be easily borne. The end once accomplished, it will be a great relief to have the cobwebs cleared from the skies and our streets relieved of their spectral disfigurements."

The plan referred to in the foregoing extract, of using paraffine oil as the insulating material of the lines, is the invention of Mr. David Brooks, an American electrician of long experience with telegraphic practice, and has always appeared to us to be one of the simplest and most economical that has heretofore been suggested. Several lines on this plan have been in use in this country for some years, and, so far as we have been advised, have given very satisfactory results; and experimental trials in Europe have been reported upon with flattering comments.

The Underground Electric Company, whose pipe line system is described elsewhere in this issue, has advertised for proposals for laying down an extensive line of their perforated pipes on Market street in Philadelphia, permission to use the street having been granted by the city authorities, and by the time this article appears the work will probably be under way.

Underground lines of telegraph are being laid in this city, from the Fire Department headquarters on Mercer street up to Houston street, then to Mulberry street and to police headquarters. We glean the following particulars from the *Sun:* "Sixty telegraph wires and six telephone wires run from the Fire Department building. Seventy-two wires are being laid under ground, so that there will be six extra wires. At the corner of Houston street thirty-four wires will be connected with the above-ground system of the Fire Department. Thirty-two wires will be carried under ground to the corner of Houston street and Broadway, where they will be connected with the above-ground wires of the department. Six wires will be laid the whole distance between the Fire Department headquarters and the Police headquarters on Mulberry street. The entire length is between 1,500 and 1,600 feet, and it will be the largest underground line yet laid in this country. In laying the wires, an excavation is made to the depth of about two feet; a wooden trough is laid down, and in this the wires are placed, immersed in a composition which, it is claimed, perfectly insulates them. This composition is a mixture of powdered glass, paraffine wax, resin and linseed oil. It is melted and poured in hot, and when it solidifies, it is a tough, hard composition, impervious to moisture and unaffected by changes of temperature. It will bend without breaking, and cannot be broken by the shifting of the earth or settling of the street bed. The wooden trough is simply a mold, which may rot away without affecting the efficiency of the cable. Instead of the ordinary galvanized iron wires of above-ground telegraphy, the wires used in the underground system are of copper, with two coverings of cotton fabric soaked in paraffine wax. In placing the wires, a half-inch layer of the insulating composition is first put in the trench; then eight wires are put down, three-eighths of an inch apart; then come another half inch of the composition and eight more wires; and so on until the seventy-two are enclosed in a rectangular cable 6½ inches wide and 3½ inches thick."

These reports are all highly gratifying evidences of progress towards the general adoption of underground telegraphy, which is sure to come, and they afford us especial satisfaction.

The Broadway Underground Railway.

The project of an underground railway beneath Broadway, which is a subject of much local interest, may ultimately be realized, but is making slow progress, being at present badly entangled in the meshes of red tape, from which it may take its supporters some time to free it. It appears that, in view of interests that might be jeopardized, of rival claimants whose alleged rights would be infringed, and of other matters affecting the desirability and feasability of the proposed underground railway, the subject has been referred by the city authorities to a board of commissioners, to whom the power has been delegated to pass upon the practicability of the proposed improvement, and to select the most suitable course. This board has held several meetings, and will probably hold a good many more before any decision is announced, as the subject appears to be getting more tangled up at each conference. An idea of the present state of the project may be gleaned from the proceedings of the last meeting of the board, which was held on the 20th of July. At this meeting a protest was presented on behalf of the corporation known as the Beach Pneumatic Railway Co., by Mr. Joseph Dixon, one of the trustees and stockholders, who claims that his corporation alone has the exclusive right to tunnel under Broadway for railroad purposes. The president of the Broadway Connecting Railway Co. objected to the reception of this protest, claiming that the proper remedy for Mr. Dixon, and those whom he represents, was an appeal to the courts, where the question of his and their alleged rights would be equitably adjudicated. Following this, came a question from a Broadway property owner, who made the significant inquiry, when the board proposed to give a hearing to the property owners. The commissioners, after consultation, announced that they had decided to give the preference of a hearing to the Underground Connecting Railway Co. on the question of the feasibility of constructing a railway tunnel beneath Broadway; that they would next hear objections to the work; and lastly, would allow the Underground Connecting Railway Co. to reply to the objections.

In accordance with this decision, testimony was received from Chief Engineer Isaac Newton, of the Croton Water Bureau of the Department of Public Works, to the effect that a tunnel constructed according to the plans of the Underground Connecting Railway Co., would not interfere with the city's system of water supply. Chief Engineer Stevenson Towle, of the Bureau of Sewers, gave testimony to the effect that the proposed railway tunnel would not in any way interfere with or injure the sewers, but, on the contrary, would improve them in some places (notably at Canal street and Broadway). Mr. Eugene McLean, a civil engineer connected with another department, testified that he had examined the company's plans, and that if the work they contemplated was carried out in accordance with them, it would not interfere with the water, sewer or gas pipes. Additional testimony was received affirming the entire feasibility of using compressed air as a motive power for engines in the tunnel over a line of ten miles in length.

With the reception of this testimony, the meeting of the board closed, to be re-opened about the middle of September, when objections to the construction of the tunnel will be received. From what has been said at the outset, there is no doubt that objectors will be there in force.

What of the Future.

The extraordinary rate at which capital is being absorbed in every form of enterprise, but especially in the construction of new railways and the extension of old ones in this country, has of late been made the theme of many warnings on the part of portions of the public press; and many persons of conservative ideas have been alarmed by these warnings into the belief that the rate at which we were pushing on was altogether too rapid to be wholesome or long continued, and that we were rapidly approaching the period of another disastrous financial collapse, like that of 1873 of dismal memory.

We are not disposed to turn an entirely deaf ear to these prophets of evil, for however unpleasant their croakings may sound when everything is lovely and everybody happy and prospering, like other unpleasant things in nature, they too have their uses; and if by their doleful jeremiads they succeed in instilling a few grains of prudence or inspiring distrust into many minds, some of the seeds that they scatter by the wayside will bear good fruit, by causing some to scan new enterprises more closely than usual before loosening the clasps of plethoric pocket-books, and by saving others from the consequences of what might have proved hasty and imprudent investments. We see nothing, however, in the business outlook in the near future to warrant fears of any serious set-back, or to interfere with our continued prosperity.

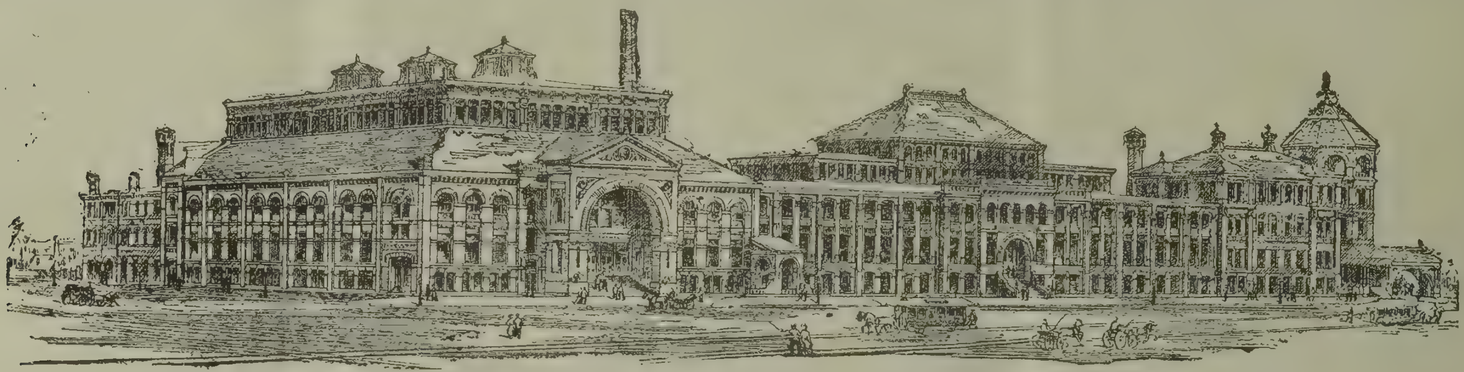
It is true that money is being rapidly absorbed in new enterprises, and it is true also that many of these are of so speculative and venturesome a character that there are but slim chances that investors in them will ever receive substantial returns; but it should be remembered that speculative schemes and unprofitable investments are not confined to seasons of prosperity, and that by far the greater part of the new enterprises now appealing for money, are really substantial and meritorious. This is especially true of the new railway enterprises, which have been the favorite theme of evil forebodings. It should be remembered too that at no previous period in the history of our country has the tide of immigration set to our shores so strongly as during the past two or three years. This immense influx is still continuing, and is adding to our permanent population at the rate of half a million yearly. The bulk of this vast stream drifts Westward, and those who are best informed as to the rate at which population is now pouring into the great States of Kansas, Missouri, Texas, Iowa, Nebraska, Minnesota, Dakota, and other States of the West and Southwest, assert that it has created the demand for new avenues of intercommunication and for transportation more rapidly than they can be supplied. So long as this condition of things continues, new railway enterprises are necessary and legitimate consequences.

Again, there never was a period when this country was as able to carry these and other great works of internal improvement through successfully, for never before have our people been so abundantly supplied with the wherewithal to execute them. The balance of trade has for several years ruled steadily in our favor by sums that run into hundreds of millions; we are rapidly extinguishing our national, State and municipal debts; our new enterprises are being largely, and in many cases, entirely carried on with our own and not with borrowed capital; and the business activity engendered by these favoring conditions is being felt through all the ramifications of our manufacturing industries.

It is to be feared, of course, that the present favoring conditions may engender a false sense of security that may call into existence the latent germs of the wild and reckless speculation and overtrading that set us all at sea some years ago; but there are no substantial reasons for fearing that such a state of things is upon us now, or even anywhere near us, as some panic mongers are predicting. The general business of the country is too healthy for that and on too substantial a basis.

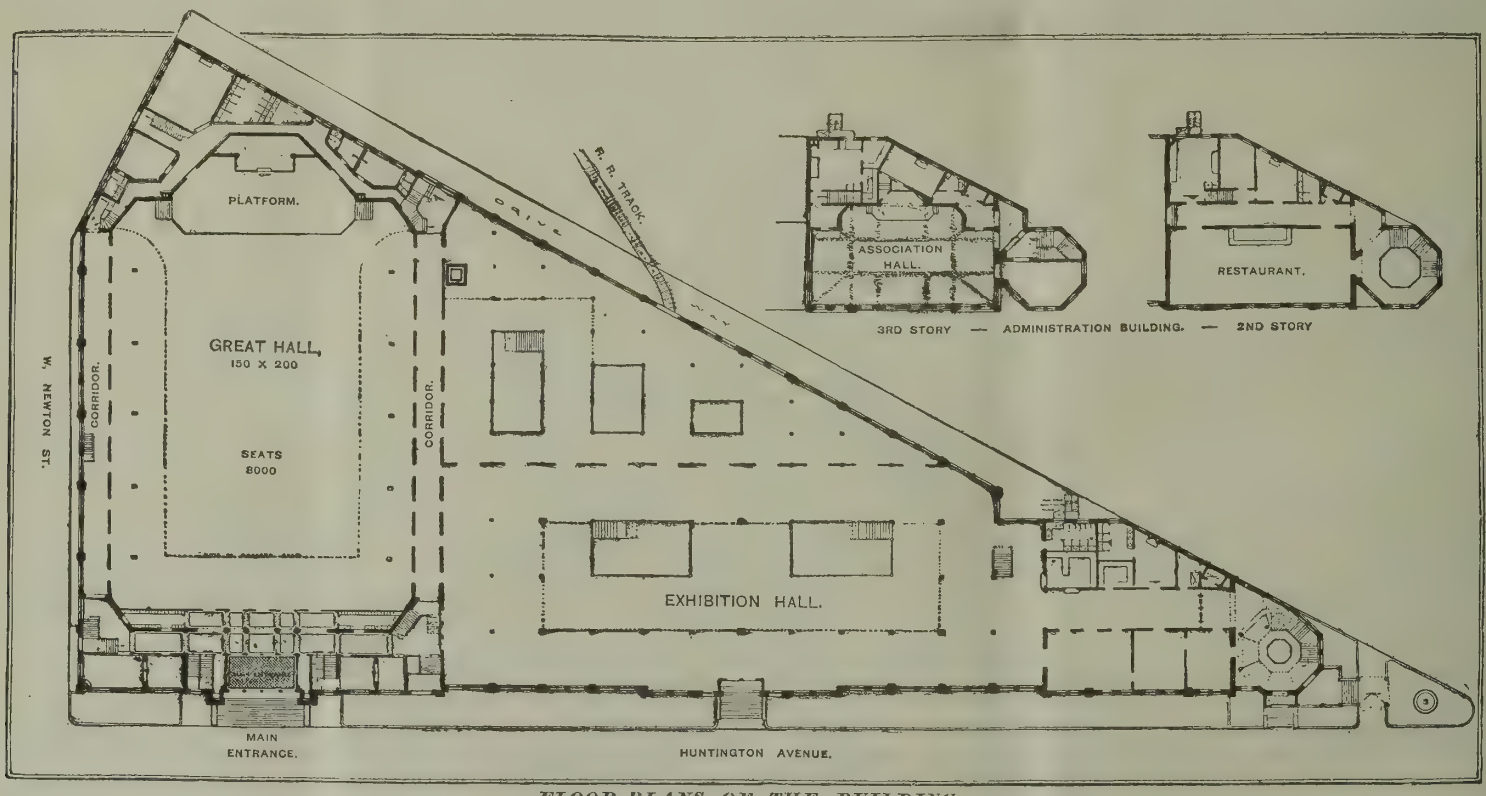
The Massachusetts Charitable Mechanic Association.

We give herewith views of the new exhibition building of the Massachusetts Charitable Mechanic Association, now in course of completion in Boston, together with a description of the objects of this model organization and of its forthcoming exhibition. This institution is one of the oldest mechanic's associations in the United States, if indeed it is not the oldest, having been founded in the year 1795. It was likewise among the first to hold exhibitions of manufactures and the arts, having held its first exhibition of this kind in the year 1837, being anticipated in this praiseworthy undertaking by only a single institution—the pioneer in establishing the custom of holding exhibitions in this country—the Franklin Institute of Pennsylvania.



NEW EXHIBITION BUILDING OF THE MASSACHUSETTS CHARITABLE MECHANIC ASSOCIATION.

Since its first experiment, the Massachusetts Charitable Mechanic Association has held thirteen triennial exhibitions, the latest having been held in 1878. All of these exhibitions proved highly successful, and were profitable. The association having long felt the need of providing enlarged accommodations for its exhibitions, succeeded last year in securing a lot of ground eligibly situated for its purposes, and at once proceeded to erect the admirable exhibition building represented in the accompanying engravings. The building, which covers a superficial area of $2\frac{1}{2}$ acres, is now up to the third story, and will be completed about the first of August. It is built of brick, with stone foundations and ornamentation, which last is aided by the artistic use of terra-cotta. We condense the following description from one of the local journals: The premises consist of three great buildings—the administration building, the exhibition building, and the grand hall, forming one group, but separated by brick walls and fireproof doors. The whole has a frontage of 598 feet on Huntington avenue, and of about 316 feet on West Newton and Gloucester streets. The building is of red brick laid in dark mortar, with stated roofs, and lanterns and dormers of iron. The walls are built vaulted and very thick, nowhere less than 2 feet, and from that thickness to 4 and 5 feet, thus giving great depth of window-opening and projection of piers. The style of the building is Renaissance in character, freely treated to accommodate itself to a building of plain and molded brick and terra-cotta. Fine detail has been avoided, but the desired effect and variety are obtained by large and marked features of construction at various points. The administration building is at the easterly end, nearest to Dartmouth street, and contains the grand entrance and staircase halls in an octagonal tower about 38 feet diameter, entirely of masonry, and devoted to that purpose. The tower is about 90 feet high, and has in its upper story an observatory from which a fine view is obtainable. Internally the administration building is divided into a basement of 17 feet in hight, with three stories above it, in the first of which are the committee rooms, secretary's and ticket offices, ladies' waiting and dressing rooms, janitor's room, general toilet rooms, a district telegraph office, etc. The second story is devoted to the restaurant, serving-room, ladies toilet, etc., and the third to the association hall, 85 by 43 feet, which will be handsomely furnished for the use of the association, and will be let for private theatricals, receptions, balls, lectures, concerts, etc. It is connected with the first-story entrance by a large passenger elevator.



FLOOR-PLANS OF THE BUILDING.

The exhibition hall is 270 by 150 feet, and has a basement 17 feet in hight, to be used for heavy machinery and other cumbrous articles. The first story is 18 feet, and the second, or gallery, 15 feet. It is lighted by an immense lantern or clerestory in the center. Two passenger elevators, as well as several broad flights of stairs, run from the basement to the second floor. In close contact with the elevator and staircase on the second floor, is the art gallery, 90 by 50 feet. The hanging hight of walls is 24 ft. and 31 ft. to the glass ceiling light. Eight studios, averaging 30 by 22 feet, which will be leased to artists after the exhibition, line the northern wall. The great chimney, 11 feet square and 110 feet high, is built in this section. The boiler-room, arranged for four boilers, is at the base of the chimney, and adjoining are solid granite foundations for the engines. Into the basement a spur track from the Boston and Albany railroad is run, and cars can be run directly into the building, where a heavy crane and all facilities for loading and unloading heavy machinery and goods is provided.

From the exhibition building, on the three stories, open twenty-seven wide doorways into the grand hall section. The entrance to the hall from Huntington avenue is beneath an arch of 34 feet span, supported upon pilasters with terra-cotta capitals, and is approached by a fine flight of granite steps 35 feet in width. The audience room is 190 by 140 feet, besides the stage recess 84 by 30 feet. Reception, dressing and committee rooms and cloak and check rooms are provided. The grand hall is surrounded on three sides with two galleries, and lighted by a great lantern or clerestory, and windows 16 feet in hight on all its sides. Directly in the rear of the grand hall are about

twenty chorus, dressing, toilet and other rooms 30 feet square and less. It is intended to made this hall perfect in its appointments, and, after the close of the exhibition, it will be available for concerts, opera, military drills, fairs, festivals or any purpose demanding a hall with a seating capacity of 8,000.

The building will be all in order for the holding of this year's exhibition, preparations for which are being at present pushed forward. The exhibition will be opened on the first of September, and will be continued during September and October.

Special efforts are being made by the administration to make the forthcoming event as far superior to its predecessors as possible, that the new building may be dedicated to its future uses with all possible *eclat*. Their efforts are, therefore, being put forth to make the exhibition a representative one in every branch of American manufacture and art. From the accounts that have come to us, the expectations of the management promise to be amply realized. The machinery exhibits, and those of the higher grades and branches of general manufactures, promise to be unusually well and handsomely represented.

Besides these general exhibits, there will be a special exhibit of building material and house decoration goods; educational products; electric, philosophical and other instruments, including every form of electric development as applied to lighting purposes, telegraphs, hotel signals, etc., complete, systematic and orderly. The department of the fine arts is also to be of unusual excellence, and this feature of the exhibition will probably be the finest ever seen in Boston, including choice pictures from Paris, Munich and American artists.

The association has always been liberal in the distribution of awards to deserving exhibitors, and will not depart this year from its old-time custom. In addition to its gold, silver and bronze medals for inventions and improvements in the arts, the association has decided this year to award a grand gold medal of large size and great value for the article most promotive of human welfare, the decision to be made by the American Academy of Arts and Sciences.

We congratulate the association on its prosperity, and will conclude our brief account of its progress with the statement that goods intended for the forthcoming exhibition will be received on and after August 15th. Further details will be furnished intending exhibitors by addressing the secretary, Mr. George B. Hanover, 40 Bedford street, Boson.

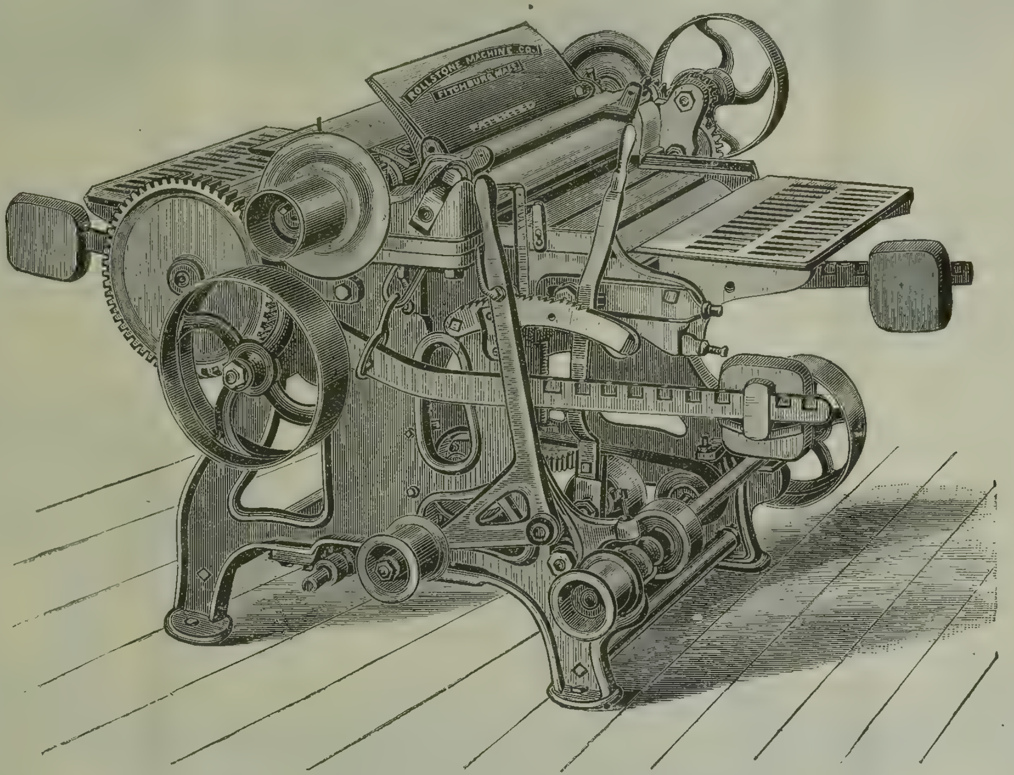
Applications of Glucose and Grape Sugar.

An important use for grape sugar is for the improvement (?) of wines, by processes devised by Gall and Petiot, and known as Gallizing and Petiotizing. Although there is no application for which grape sugar is used that could not be equally well accomplished by the use of common cane sugar, yet the latter is so much more expensive that the former is generally preferred where it can be had pure.

The syrup of glucose finds much application in beer-brewing, in the distillation of ardent spirits, and as an admixture to honey and to sugar-house syrups. It is also largely used by confectioners and candy-makers. Glucose is much used for the preservation of fruits and for the fabrication of fruit syrups. The article known as grape sugar serves as the raw material for the production of "sugar coloring," an article used for imparting the brown color to cordials, liquors, wines, vinegar and cognac. In this list we have made no mention of the use of grape sugar for adulterating cane sugar, a species of falsification which there is good reason to believe is very extensively practiced.

Improved Rotary-Bed Planer.

We illustrate and describe herewith the improved rotary-bed planers manufactured at the well-known wood-working machinery establishment of the Rollstone Machine Company, of Fitchburg, Mass. These machines are made from entirely new patterns, and embody in their design and construction every improvement, down to the latest, that has been tested and found to be desirable. They are provided with double balance-wheel driving pulleys on the cutter-head; the cutter-head and journals are made of steel, forged together in one piece and finished with ground journals $1\frac{3}{4}$ inches in diameter, which run in self-oiling boxes. They are further provided with a special device of this establishment—a patent frictional adjuster, by which these planers are made adjustable for dressing from $\frac{1}{8}$ inch to $7\frac{1}{2}$ inches in thickness. This frictional adjuster is positive in action, quick, accurate, simple in construction, and durable. In further description of these machines, we may mention double pressure rolls; front and back rolls weighted, and entering roll geared, which, together with the revolving lag bed, make a very powerful feed, which can be relied upon to overcome the difficulties encountered with wet, pitchy or icy lumber. The machines have an improved, close-jointed, extra heavy revolving bed, running over steel ways. They are made very heavy, and none but the best materials are permitted to enter into their construction. All the journal boxes are lined with Babbitt metal, carefully made in the establishment for the purpose.



NEW PATTERN 22, 24 AND 27 INCH PLANERS.

The new pattern planers are made of three sizes—22, 24 and 27 inches respectively, and their capacity varies according to size from 3,000 to 4,000 feet per hour. They are especially suited to meet the requirements of ship-yards, car-shops, lumber mills, cabinet and furniture shops, and will be found adapted for all kinds of light and heavy surfacing where smooth and rapid work is required.

By reason of their many excellent features and very general serviceability, these machines have become very popular; hundreds of them are at present in use throughout the country, and we are advised by the manufacturers that they are pressed to supply the great and growing demand for them, which has necessitated running the works day and night.

This company also build a double surfacer, with all the latest improvements—a machine second to none, and the general style of which is the same as the above.

The address of the manufacturers is The Rollstone Machine Co., 25 Water street, Fitchburg, Mass.

Bricks.

American bricks are generally about $8\frac{1}{4} \times 4 \times 2$ inches in size, and weigh about $4\frac{1}{2}$ pounds each. Machine-made bricks generally weigh more than hand-pressed. Their weight is thus about 118 pounds per cubic foot. A cubic yard will weigh about 3,186 pounds, or 1.42 gross tons. A thousand will weigh about 2.01 gross tons.

Pressed bricks used for fronts weigh about 5 pounds; 31 pounds per cubic foot; 3,537 pounds (1.58 gross tons) per cubic yard; and 2.23 tons per thousand. These weights are for dry bricks. Any brick will absorb from one-half to three-quarters of a pound of water if immersed for a few minutes—that is, the hand-made brick will absorb one-seventh of its weight of water, or one-third of its bulk.

As mortar weighs only a very little less than bricks, we may assume the weight of a brick wall laid in mortar to be about 1.4 tons per cubic yard, 1.3 tons per perch of 25 cubic feet, or 116 pounds per cubic foot; the above figures being for hand-made bricks. For machine-made bricks, we may say 1.56 tons per cubic yard, 1.44 per perch, and 129 pounds per cubic foot.

There is a certain amount of waste in cutting bricks to corners, jambs, etc., so that we may say, allowing for this waste, that the following figures will show the number of bricks needed per square foot of wall:

Thickness of Wall.	Number of Bricks.
$8\frac{1}{4}$ inches, 1 brick	14
$12\frac{3}{4}$ inches, $1\frac{1}{2}$ bricks	21
17 inches, 2 bricks	28
$21\frac{1}{2}$ inches, $2\frac{1}{2}$ bricks	35
$25\frac{3}{4}$ inches, 3 bricks	42

A bricklayer who has a laborer to keep him supplied with materials, can lay in ten hours about 1,500 bricks in common house brick. But in ordinary outer faces of brick buildings, he can only lay 1,000 to 1,200; in ordinary straight fronts, only 800 to 1,000; while in the very finest lower stories on street fronts he can lay only about 150 to 300, by reason of the greater nicety required, the greater number of angles, etc. In plain, massive engineering work he can lay about 2,000, which will make about 4 cubic yards. In laying large arches, he can put in about 1,500 bricks per ten hours, which will make about 3 cubic yards.

Mending Plaster Casts.—Plaster casts may be mended by using a cement made by dissolving small portions at a time of celluloid in ether. No more of the cement should be made than is required for use. It hardens almost immediately by the evaporation of the solvent.

An Improved Method of Carrying Underground Telegraph and Telephone Lines.

One of the most practical steps towards meeting the requirements of underground telegraphy, has been taken by the National Underground Electric Company, whose pipe line system for carrying wires and cables for telegraphic and telephonic purposes we describe and illustrate in the following.

The plan of this organization is novel, in that it does not propose to lay and operate telegraph or telephone lines of its own, but simply to furnish the existing telegraph and telephone companies with their underground pipe line, capable of accommodating any desired number of wires, and to keep and maintain the same in good working condition, for a term of years, under properly executed leases or contracts, the company expecting to derive its revenues from a system of rental based upon a certain schedule of charges per mile of wire. This plan is free from the impracticable features of some of the methods of underground telegraphy that have lately been proposed, in that it does not bring its advocates into conflict as business rivals with the existing telegraph and telephone companies, and is not committed to the use of any particular mode of construction, preparing and insulating wires or cables, but, on the contrary, proposes to accommodate all comers with the facilities for conveying their lines underground.

We have thought this preliminary explanation of the nature and objects of the company necessary, for the reason that we, as well doubtless as many others, have at first been misled by the name of the organization into the belief that it was an underground telegraph company. From the foregoing remarks, our readers will understand that it is a pipe line company for affording telegraph and telephone companies facilities for carrying their lines underground. With these explanations, we proceed with the description of the special plans of the company, which are protected by several letters-patent of the United States.

The method of constructing the pipe line is as follows: Cylindrical pipes of terra-cotta are made, perforated lengthwise with numerous small holes, forming continuous tubes, covered with a vitrified glazing on the outer and inner surfaces. The pipes are designed to be laid end to end underground, and firmly cemented together (this being easily accomplished, the pipes having a bell or socket on one end of each), thus making a continuous line of terra-cotta pipes, through which the wires or cables are run. The construction of these pipes is shown in Fig. 1. These are laid in sections, and at convenient distances excavations are made in the ground and carefully bricked and cemented up, thus making an underground water-proof chamber between each section (such sections being of any desired length), by which system of underground chambers, in connection with the conduits, the wires can be withdrawn and replaced at will, and the number decreased or increased as required for any purpose, without digging up the streets, which has been strongly urged as an objection to the underground telegraph in cities. As the pipes are laid, small wires are placed in the holes, all the wires in each section ending in the sunken chambers. The design of this is to enable the workmen in the chambers to draw the cable or bundle of wires through the perforated blocks, by means of a reel, as fast as needed.

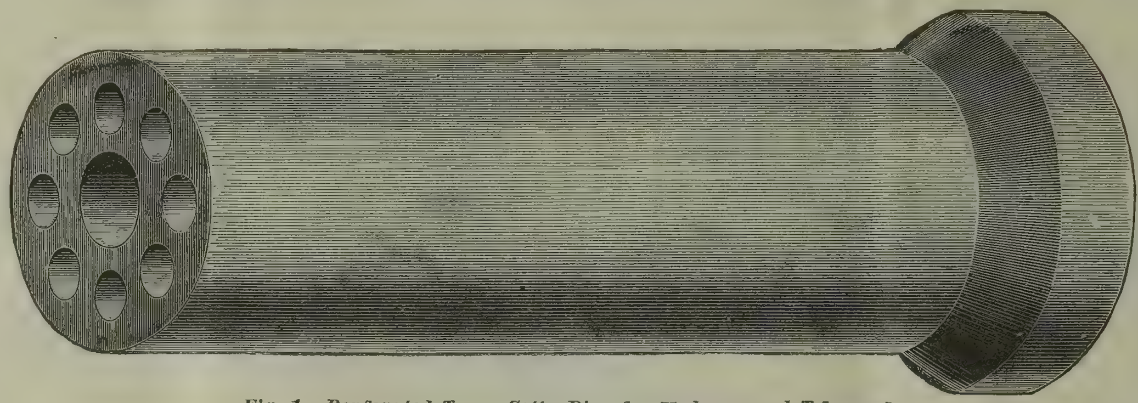


Fig. 1.—Perforated Terra-Cotta Pipe for Underground Telegraphy.

Fig. 2 is a section showing the pipe line in position, and the method of drawing the wires through the same.

When a section is laid and ready for use, a rubber pipe or hose is drawn through the holes in the pipes, and in this the insulated cable is placed, thus encasing it in a vitrified terra-cotta pipe, lined with rubber—a threefold protection against the dampness of the earth. The different kinds of wires may be completely separated, while a small pipe may carry a thousand wires without inconvenience. Branch lines will be laid to offices and buildings, by pipes laid under the pavements, from the chambers at the ends of the sections. These chambers are designed to be covered when not in use, and will not interfere with street traffic. The company claim that their system is much cheaper than any hitherto proposed, and it certainly has the merit of removing the wires from the streets and house tops, and at the same time preventing the continual tearing up of the roadway to lay new cables or repair old ones, which is a grave objection to other systems. By this system, there is no danger of our telegraph, telephone and other wires being broken down and communication interrupted, as was the case during the last winter on several occasions, and for days, thus entailing great loss on the business community.

The company claim for their pipe line system a number of advantages, of which the more prominent are named below: Efficient protection against ground moisture, which would affect the insulation of the line wires; the great facility which it affords for handling the wires or cables, either for introducing new ones or withdrawing or repairing the old ones; the complete avoidance of the objection of disturbing and tearing up streets and pavements to meet the demands for additional wires after the line is once laid; the fact that they propose to accommodate all comers with facilities of an underground conduit for all kinds of wires and cables; and the provision of separate chambers for wires of different lines.

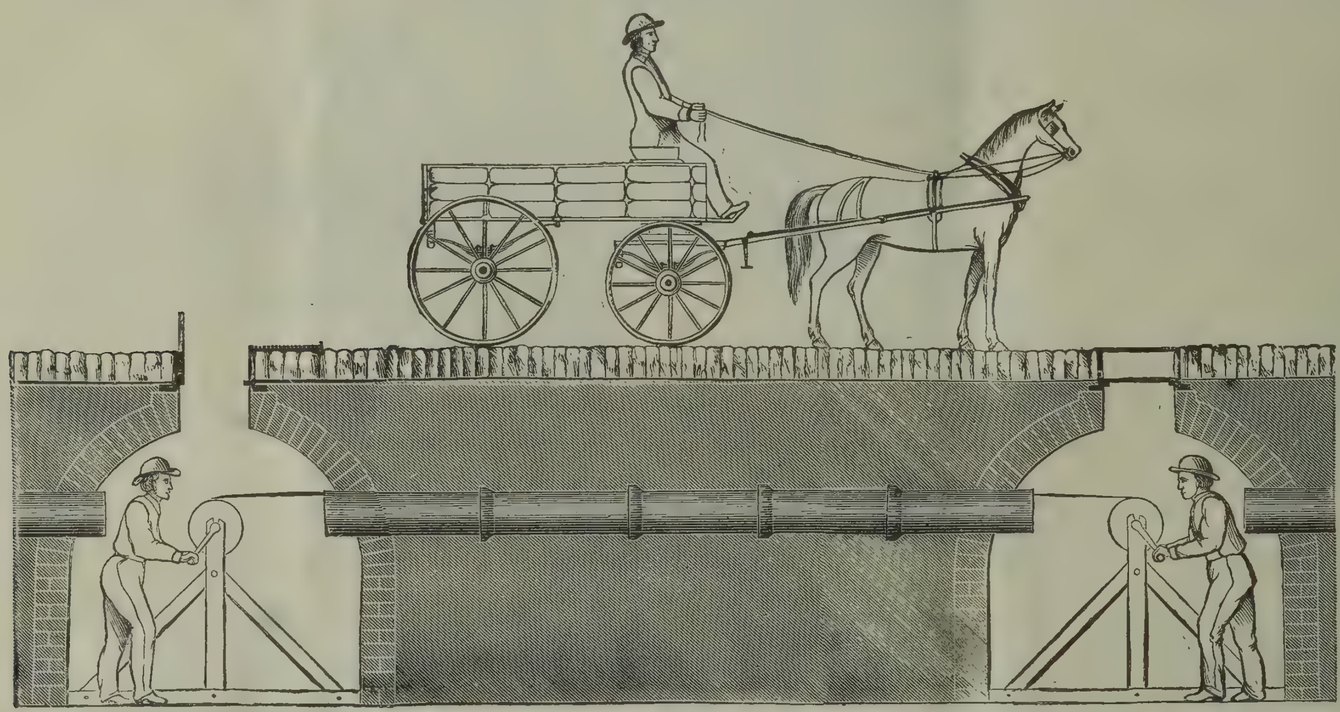


Fig. 2.—Section of Pipe, with Testing Stations, Showing Manner of Inserting Wires. These Testing Stations may be any Required Distance Apart.

From the above description, the company's system would appear to be as simple and efficient as any that could well be devised, and it certainly answers many of the objections that have been advanced against the underground telegraph in cities. When once laid down in the street, it is there for good, and capable of accommodating any reasonable increase in the number of wires that will be likely to occur for years. The material of the pipes is practically indestructible, which cannot be said of lead or iron under the same circumstances; and the means provided for manipulating the

wires is at once simple and satisfactory.

The efficiency of the system has been tested on a limited scale in Camden, N. J., where a line of these terra-cotta pipes was laid down in Arch street, in September, 1880, in one chamber of which a telephone cable of forty wires was drawn, to which connection was made with the wires of the South Jersey Telephone Co. This line is reported to have given complete satisfaction. To test the possibility of withdrawing and inserting the wires without disturbing the street, the telephone cable was withdrawn and a bunch of telegraph wires inserted. The latter were subsequently subjected to careful electrical tests, and their insulation found to be excellently preserved.

The company has lately been granted the privilege of laying their pipe line in Philadelphia, and branch companies are being formed, or have already been formed, in Chicago, Boston, Baltimore and other cities, where we may soon expect to see their system in practical operation.

The main office of the National Underground Electric Company is at 29 Market street, Camden, N. J.

Railroad Construction in 1881 has been seriously interfered with by the snow blockades, and other obstructions to traffic resulting from the severe winter through which we have just passed. The unparalleled prosperity of this country during the past year, gave origin to many new projects of railroad construction; but though more miles of new road are projected for the present year than ever before, the first three months of 1881 have witnessed less work accomplished is this field of enterprise than during the same period of 1880. The *Railroad Gazette*, which is our authority for this statement, reports the new mileage of 1881, up to the close of March, to be 778 miles, as compared with 964 miles for the same period of 1880.

Improved Appliances for the Transmission of Power.

We give in the following a description of certain standard appliances used in the transmission of power, which, by concurrent testimony, represent in their design and construction a high grade of excellence.

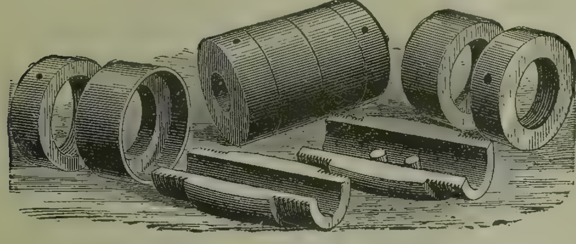


Fig. 1.—Collins' Self Adjusting Coupling.

Fig. 1 of accompanying cuts gives a view of what are known as Collins' patent self-adjusting, double-compression couplings. These couplings, by the simplicity of their construction and their self-adjusting quality, adapt themselves admirably to their intended uses. The sleeve is made in halves, and is bored somewhat smaller than the diameter of the shaft it is designed to fit. The sleeve is firmly compressed upon the shaft by means of cone rings, which are forced upon it by ring nuts on both ends. The joint thus made is of the strongest possible kind, and is ample to prevent the slightest movement in the connection. As the shafts are not turned down at the ends, the necessity for centering or putting them in a lathe is obviated, and no loss of strength is suffered. This coupling has neither bolts nor keys, and is put on and taken off with great ease. It is claimed to possess to a high degree the qualities of simplicity and strength, which are the prime requisites of fittings of this kind.

Fig. 2 represents a simple and efficient form of hanger. The design and construction of these appliances are made so apparent by the engraving, that a lengthy description is unnecessary. They are made self-oiling by the rotation of the shaft over an automatic draft tube communicating with the oil reservoir, the arrangement of parts being such that the oil, after thoroughly lubricating the shaft, is returned to the reservoir, to be used again, thus obviating the necessity of a separate drip-cup, and dispensing likewise with the use of wicks, packings and other additional and objectionable parts. The hanger, it should be observed, is also entirely self-contained.

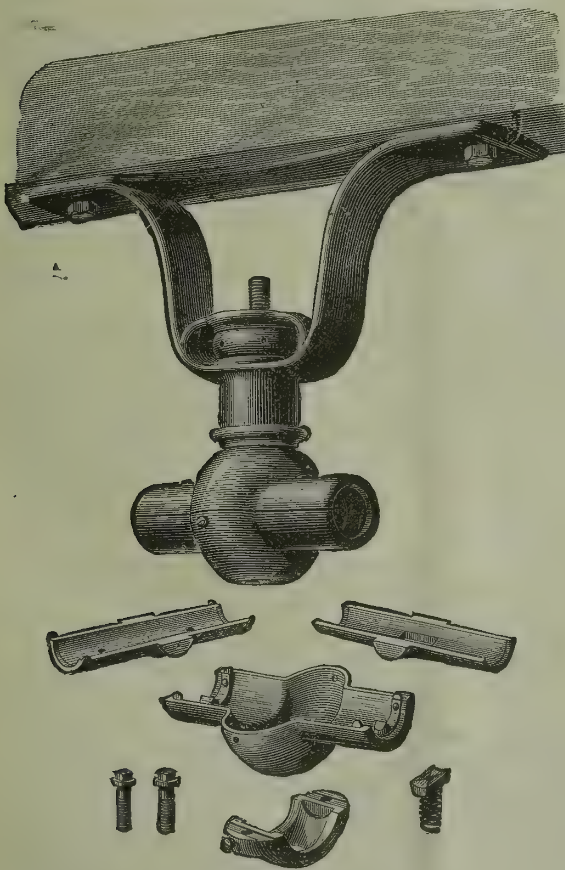


Fig. 2.—Improved Self-Oiling Hanger.

Figs. 3 and 4 are views respectively of clasp and solid pulleys, which require no extended description, save mention of the fact that the patterns that have been adopted by the makers are of the most approved style, embodying lightness, symmetry and strength. These pulleys are provided with steel-pointed set-screws.

Further information respecting these appliances may be obtained by addressing the George Place Machinery Agency, 121 Chambers and 103 Reade streets, New York.

Recasting Old Bearings.

This frequently becomes necessary in the practice of every wood-worker, and should be done understandingly. To remove the old metal, take a narrow cold-chisel and cut a groove entirely through the middle of the old Babbitt, longitudinally. Each half can then be removed easily and in one piece. Extract from the cap in the same manner. Clean the cavities thoroughly. If the box is of the self-oiling pattern, wedge the opening of the oil-holes completely full of wood and projecting up enough to touch the shaft when the latter is in position. Line up, packing the end of the boxes with cardboard, that the shaft may not bear against iron at any point. Also pack about one-16th inch of pasteboard against the shaft, on each side, under the cap, which must be screwed down firmly. Use putty or stiff clay to stop all cracks.

The Babbitt metal is ready for use when heated sufficiently to char a pine stick. When practicable, both sides of the bearing should be poured simultaneously, as there will be less danger of springing the shaft. Do not have the metal too hot, as the shrinkage will be in proportion to the temperature. Have everything perfectly dry, and a free gate for the escape of gases, if you would avoid explosion. Remove the cap, trim all edges rounding, and with proper tools open all oil holes. Finally, it is best, although not always essential, to scrape the bearing to a fit.

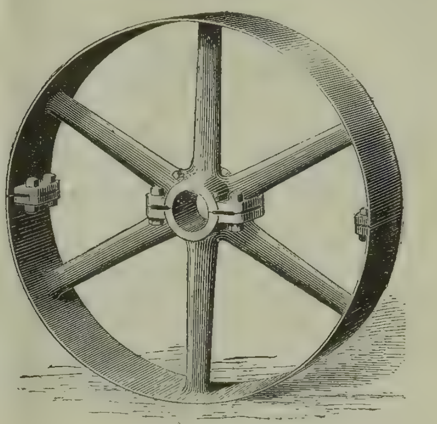


Fig. 3.—Clasp Pulley.

Tree Culture on Waste Land.

Hitherto the abundance of natural timber in this country has made it easy to dispense with timber culture, and for the most part our land owners have taken little interest in such slow-growing crops. This state of things, however, is rapidly passing away. The demand for special woods for manufacturing purposes is steadily and rapidly increasing, while the natural supply is diminishing, and must ultimately become quite inadequate. Meantime there are millions of acres of land suitable for timber culture and for nothing else, except poor pasturage that our land owners are allowing to lie waste and idle for lack of a little forethought, and too frequently our would-be thrifty farmers will risk their surplus means in wild-cat speculations, promising, but never yielding, large and speedy returns, when the same money, spent in planting timber, would soon convert their worthless swamps and stony places into valuable properties.

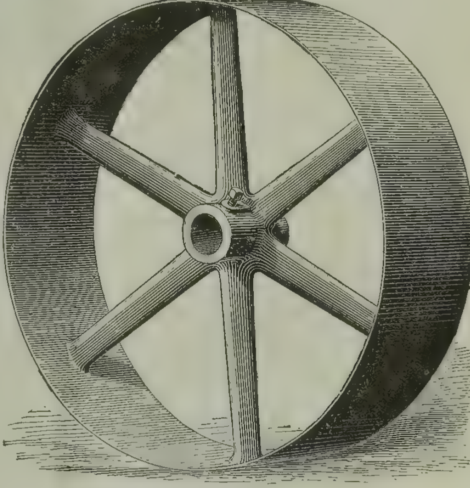


Fig. 4.—Solid Pulley.

A correspondent of the *Scientific News*, writing from Wisconsin, tells of a piece of land that was planted with walnut twenty-three years ago. The land was flooded every spring and summer, and was unfit for ordinary cultivation. The trees are now from 16 to 20 inches through, and have been sold for $27,000. No particulars are given as to the cost of planting the grove, or the amount of attention it has had during the years of growth. There can be little doubt, however, that the investment was small in comparison with the return, and the land would otherwise have remained entirely unproductive. To the country the timber

crop was so much clear gain. It is clear that our national resources might be enormously increased by a similar utilization by timber culture of lands which are now left unused and unproductive; and the planters would find their groves a surer investment for the security of their family possessions than any savings bank deposit.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

Henry C. Cook will build shortly, on the corner of Fifth avenue and Seventy-eighth street, a three-story house, costing $200,000.

Nearly all the hotels are being enlarged or renovated. In addition to those already mentioned, are the Grand Union Hotel, the Hoffman House, and the Hotel Devonshire.

On One Hundred and Sixth street, between Second and Third avenues, Mrs. Lottie N. Dean intends to build four four-story flats, 20 by 55 feet. They will have brick fronts with stone trimmings. The cost is to be $40,000.

On the east side of Lexington avenue, 25 feet south of Fifty-second street, there is to be erected a single apartment house, 25 by 80 feet, five stories in hight, and of brown stone. A. B. Ogden is the architect. The cost is to be $20,000.

The Liederkranz Club will build on Fifty-eighth street, between Park and Lexington avenues, a club house of brick and stone, 125 by 100 feet, according to the designs of H. J. Schwarzmann and Wm. Kuhles. The cost is to be about $100,000.

C. W. Goodrich will erect five houses, 20 by 62 feet, four stories high and basement, of brick with Nova Scotia stone trimmings, on the south side of Forty-second street, between Seventh and Eighth avenues. A. H. Thorp is the architect. The cost will be $100,000.

On the northwest corner of One Hundred and Twenty-fifth street and Sixth avenue, E. H. Just is going to put up a five-story and basement flat, 100 by 100 feet 11 inches, from designs of M. C. Merrit. It will be built of brick with bluestone trimmings, and will cost $75,000.

At Nos. 21, 23 and 25 Warren street, Mayer, Merkel & Ottmann are about to make extensive alterations to their lithographic establishment. It will be 69 feet 6 inches by 75 feet, five stories in hight, and constructed of brick with marble and brick front. J. Kastner is the architect.

The supply of all kinds of skilled labor has continued scarce during the past month, and prices naturally have been very firm, with a probability that in some instances a small advance may take place. No strikes, except on single jobs, have taken place, and these were settled by the parties immediately interested.

On the north side of One Hundred and Twenty-first street, 150 feet west of Avenue A, C. L. Wieher is to put up four flats, 18 feet 9 inches by 53 feet, with extension 12 by 12 feet, and four stories in hight. They will be constructed of Philadelphia brick with brown stone trimmings. J. H. Valentine is the architect, and the cost is to be $40,000.

Abram S. Hewitt proposes to build a large private stable on the site of the old St. Germain livery stable, in Twenty-second street, between Fourth and Lexington avenues. It will be 25 by 100 feet, of brick, and two stories in hight. The stable will have several unique features, comprising an open timbered roof, with dormer windows. H. E. Ficken is the architect, and the cost will be about $10,000.

Extensive alterations are to be made to the Hotel Brunswick on Fifth avenue, taking in the Lottimer house on Twenty-sixth street, the Livermore house on Fifth avenue, and the Fisk and Hume houses on Twenty-seventh street. The alteration will comprise a ladies' ordinary, ball-room, and a large banqueting hall. The entire cost will be upwards of $200,000. H. E. Ficken is the consulting architect.

There is to be erected an apartment house for bachelors at Nos. 130, 132, 134 and 136 West Forty-first street. The building is to be 79 feet 10½ inches front by 88 feet 9 inches deep, and eight stories high. From the curb level to the highest point the distance will be 100 feet 6 inches. The front will be of brown stone, and the structure will cost $110,000. E. Mott W. Todd is the owner.

James A. Frame is to build a five-story apartment house, with store underneath, on the northwest corner of Eighty-fourth street and Second avenue. The cost is estimated at $16,000. He will also put up a row of six five story flats and stores on the west side of Second avenue. The buildings will be 25 by 60 feet each, containing two stores and apartments for eight families. The entire cost will be $84,000.

B. Spaulding will soon erect six houses in Sixty-seventh street, between Madison and Fifth avenues. Four of them will be 25 by 56 feet, with extension 17 feet 8 inches by 34 feet, and two 23 by 56 feet, with extension 16 by 32 feet. They will be four stories high, four of brown stone and two of brick with terra-cotta trimmings. The cornices are to be exceedingly fine. Thom & Wilson are the architects. The cost will be $180,000.

The building trade is not a little unsettled by the demands of the laborers. Good bricklayers get $4 a day, and in some few instances have demanded and get $4.50. Architects say that this is frightening capitalists who think of building. They compare the prices of bricks and other material with those obtained a year ago, and conclude it will not pay to build at such figures. This check to building is awkward to architects, builders and others.

Miscellaneous.

H. E. Ficken is now engaged upon plans for a magnificent stable to be built by Mr. Tracy, at Plainfield, N. J.

Wm. H. Williams, Esq., of Astoria, L. I., is erecting a commodious residence from designs by Horace G. Knapp. Wm. McBride is the builder.

William Brodie, of Hunter's Point, L. I., is about to erect for himself an elegant cottage residence, designs for which are now in course of preparation by Horace G. Knapp.

A saw-mill and sash and door factory, to cost $50,000, is to be built at Clinton, Ia., by Curtis Bros. & Co. The architect is G. W. Nichols, and the builder John Anderson.

George L. Brown, the broker, is going to erect a private residence at Washington, Conn., from designs by R. M. Upjohn. It will be 50 by 72 feet, two stories in hight, with gable roof, and built in the Queen Anne and Gothic style.

Edwin M. Field is about to build a fine private residence at Irvington, N. Y., from designs by Edward H. Kendall. It will be 100 by 125 feet, three stories high, and constructed of stone, brick and terra-cotta, at a cost of $100,000.

Steinway Brothers, piano manufacturers, are about to build at Astoria, L. I., twelve cottages, ranging in cost from $1,200 to $2,000. William McBride, of Astoria, is the builder, and Horace G. Knapp, of New York, architect.

Several capitalists have purchased a block of property near the bridge at Seabright, N. J., on which they propose to erect stores, with apartments over them, together with a large livery stable and fine summer hotel, from designs by H. E. Ficken.

The Dutcher Temple Company, of Hopedale, Mass., have plans completed for a four-story brick building, 40 by 80 feet, to be erected on the site of the present manufactory. Connected with it will be a boiler-house and engine-room, 40 by 50 feet, one story high.

The Hoboken & Land Improvement Company are building machine-shops and a foundry at Hoboken, N. J., which will have a frontage of 204 feet on River street, and a depth of 77 feet on First street, and be three stories high. H. Edwards Ficken is the architect.

Chas. L. Carson is preparing drawings for two warehouses to be built on Liberty street, between German and Lombard streets, Baltimore, Md., for Lewis Seldner and A. Brafman, each to be 25 by 85 feet, three stories high, of brick with stone and terra-cotta finish.

A sanitarium, measuring 30 by 40 feet, is now being built at Andover, Mass,, for the Phillips Academy, at a cost of $10,000. The mason-work is being done by Donahue Bros., and the carpenter-work by Kelley & McNamara, all of Boston. E. A. P. Newcomb, of Boston, is the architect.

H. Edwards Ficken has completed plans for a handsome residence at Plainfield, N. J. It is to be 54 by 64 feet, three stories high, and built of a combination of wood and iron. The upper story will be shingled. It will be built in the early English style, and will cost $16,000.

R. B. Eastman has completed plans for a three-story brick and brown stone private residence, to be erected by Com. J. R. Maxwell, on the corner of Eighth avenue and Union street, Brooklyn, N. Y. It will be 48 by 95 feet, finished in hardwood throughout, and built in the suburban villa style. The cost will be $50,000.

The New York Mutual Improvement Company have purchased of G. S. Chapin, cashier of the Dime Savings Bank of Brooklyn, a plot of ground on the corner of Franklin avenue and Butler street, Brooklyn, N. Y., 100 by 131 feet, on which the company will erect ten three-story, high-stoop houses. They will be built of brick with brown stone trimmings.

Wyatt & Sperry have just completed the drawings for a row of twenty-two dwellings, to be built on Calvert street, between Eager and Chase streets, Baltimore, Md., to be 65 feet deep and have an average frontage of 18, 20 and 22 feet, four stories and basement, of brick with stone and terra-cotta finish. The cost will be between $250,000 and $300,000. Geo. A. Blake is the contractor.

There is now in course of construction, at Lima, O., a mammoth building which is to accommodate the Allen County Bank, an opera-house, and a large number of stores, offices, etc. The work is being done by B. C. Faurot, president of the bank. The architect is Oscar Cobb, of Chicago.

Boston architects are engaged on preliminary competitive drawings for a soldiers' memorial building, to be erected in that city, to cost from $50,000 to $60,000. None but local architects are to compete. The building is to occupy a site in the center of the city. It will contain artillery accommodations, a memorial hall for war relics, etc., a G. A. R. hall, a large drill-room, etc. The result of the competition is soon to be decided.

The trustees of the common lands of the town of Gravesend, L. I., decided at a meeting held recently, to accept an offer of $180,000 for the portion of the common lands extending from the east of the point to opposite the old wooden pier—a tract of about 136 acres. This offer was made by Charles E. Loew, President of the Ocean Pier and Navigation Company, which runs the iron steamers. It is understood that, if Mr. Loew secures a good title, he will erect a first-class hotel, a number of cottages and a large bathing pavilion, at a cost of more than $500,000.

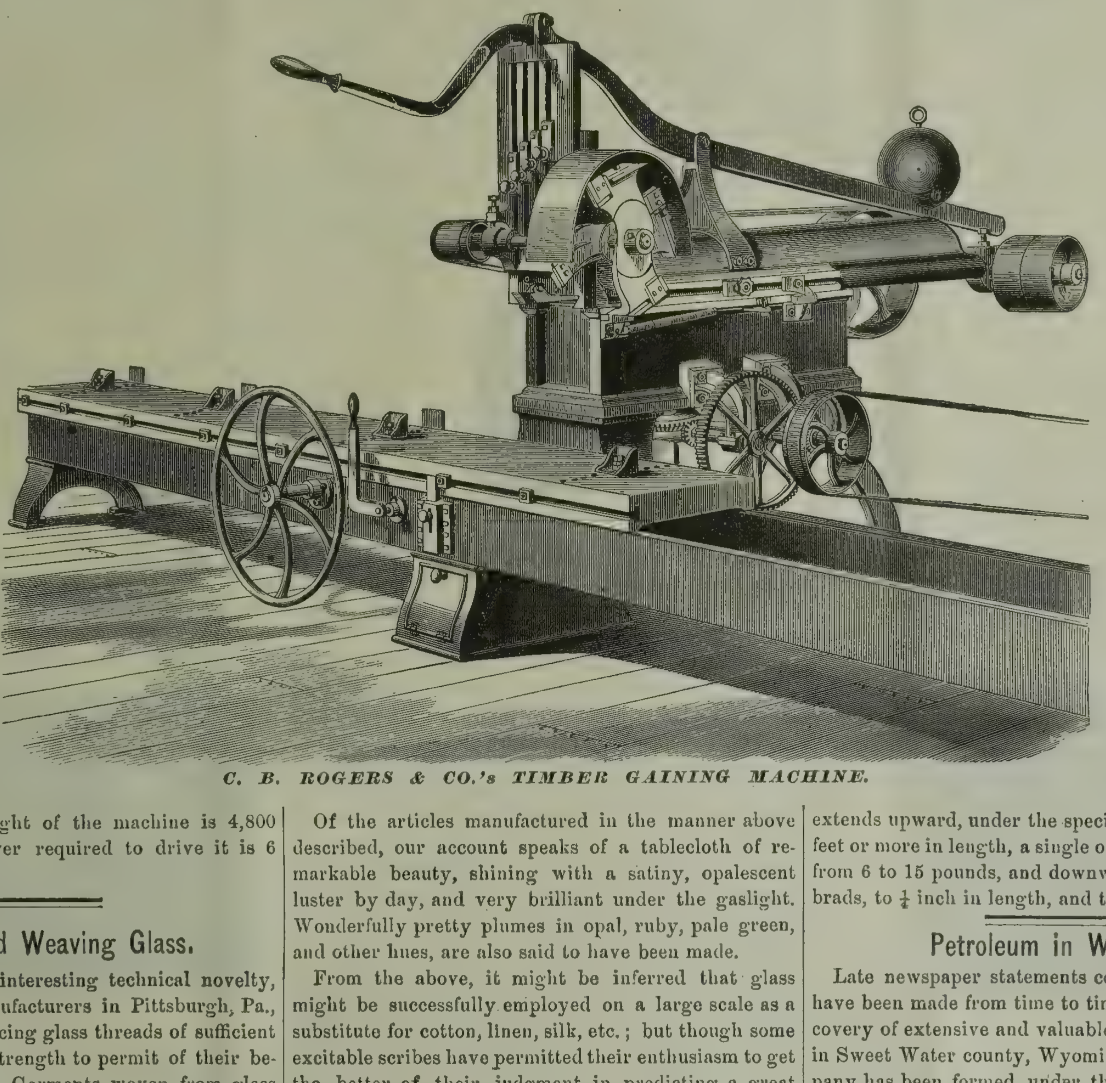
A. L. Dennis is about to erect a five-story apartment house, 60x100 feet, on the corner of Lombard and Broad streets, Newark, N. J. It will be known as the Aldine Apartment House. It will be faced with Trenton brick on the front, and relieved with selected North River stone. On the north side the roof is to be of slate. It will contain twelve suites of apartments. Besides the drying room, servants' and janitor's apartment, each suite of apartments will have a reception parlor, dining-room and kitchen. It will be heated by steam, and have an Otis elevator running from the basement to the upper floor. Wm. Halsey Wood is the architect. The cost is to be $50,000.

Timber Gaining Machine.

We illustrate herewith a special machine embodying a number of improvements, manufactured at the extensive wood-working machinery establishment of Messrs. C. B. Rogers & Co., of Norwich, Conn., who have warerooms at 109 Liberty street, New York.

The machine in question is designed for making gains in timber for car, bridge and other extra heavy work. It consists of a table 12 feet long, on ways of suitable length, the stuff being held firmly on the table by adjustable knee-blocks. The cutter-head is in two sections, arranged to adjust to the width of gain required; its arbor is hung in a yoke or frame which adjusts vertically for the depth of gain, regulating the depth by adjustable stops. This frame is gibbed to a horizontal frame, movable on gibs on the standard, transversely with the table. In operation, the timber being clamped to the table, the cutter-head is brought down by the lever to a suitable depth for any required gain—regulated by the stops; the lever in front then throws the feed into gear, and the head moves with a reciprocating motion across the stick once, and, on its return, throws out of gear automatically. The table may then be moved by the large hand-wheel for the next gain, the stops on the side regulating the distance. It will be seen, that, after setting the different stops once, the work does not require laying out.

The feed for the head has two speeds—quick for soft, and slow for hard wood. The machine is furnished with a counter-shaft, the tight and loose pulleys of which are 12 inches diameter, 6 inches face, and should make 250 revolutions per minute, giving the cutter-heads 1,000 revolutions. The counter-shaft should be placed directly over the back counter on the machine. The weight of the machine is 4,800 pounds, while the power required to drive it is 6 horse-power.



C. B. ROGERS & CO.'s TIMBER GAINING MACHINE.

Spinning and Weaving Glass.

It is reported as an interesting technical novelty, that a firm of glass manufacturers in Pittsburgh, Pa., have succeeded in producing glass threads of sufficient fineness, elasticity and strength to permit of their being woven into fabrics. Garments woven from glass fiber by this novel process, are said to have been successfully made, and the announcement of the fact has given rise to quite an amount of speculation as to the future utility of the process.

The plan of the manufacturers in question—Messrs. Atterbury & Co.—which is quite interesting to follow, is thus described: The glass employed for the purpose is similar in quality to that used for tableware. From this, rods averaging half an inch in diameter, and of various colors, are drawn out to any desired length. These rods are then so placed that the flame of two gas burners is blown against that end of the rod pointed towards the large "spinning" wheel. This wheel is 8½ feet in diameter, and turns at the rate of 300 revolutions per minute. When the flame of the burners has heated the end of the glass rod almost to the melting point, a thread of glass is drawn from the softened extremity and affixed to the periphery of the wheel, which has about 12 inches face. The wheel is simultaneously set in motion, and the glass thread is drawn out from between the burners and reeled upon the wheel at the rate of 7,500 feet per minute. By increasing the speed of the wheel, a finer thread is obtained, and *vice versa.* In passing from the flame to the wheel, a distance of some five or six feet, the glass thread is cooled off, but its elasticity is preserved. When enough of the thread has been reeled upon the wheel, the next operation is to remove the layers, which is accomplished without difficulty; and it is then cut into convenient lengths and woven on a loom similar to that used in weaving silk goods.

In the earlier trials at glass weaving, only the woof of the fabric was of glass, but lately fabrics have been woven of which both woof and warp were of glass. The manufacturers of these novel products have sent samples of their work to New York and Chicago, and it is reported that they claim to be able to duplicate any garment or other woven article sent them, in color, etc.

Of the articles manufactured in the manner above described, our account speaks of a tablecloth of remarkable beauty, shining with a satiny, opalescent luster by day, and very brilliant under the gaslight. Wonderfully pretty plumes in opal, ruby, pale green, and other hues, are also said to have been made.

From the above, it might be inferred that glass might be successfully employed on a large scale as a substitute for cotton, linen, silk, etc.; but though some excitable scribes have permitted their enthusiasm to get the better of their judgment in predicting a great future for fabrics of glass, we do not expect much from the innovation. There will no doubt be a considerable field of utility open for these novel fabrics when their manufacture has been properly perfected, in the production of colored plumes for hats, and for similar ornamental objects, but the manufacture of glass fabrics for wearing apparel we regard as quite impracticable. The manufacturers may be able to produce a woven fabric which possesses as a whole considerable flexibility and strength, but the individual fibers are still brittle, and the contact with the skin of the fine spiculæ of the fibers as they wear off or break off, would be simply unendurable. While, therefore, we regard the new process as highly interesting and useful, it will be as well at the outset not to credit such extravagant views of its extended utility as have been given out.

Driving Nails by Machinery.

Nails are now driven by machinery in most box factories where sufficient system and repetition exist to make it profitable, one machine doing the work of ten or fifteen men. The general idea of these machines is as follows: The nails are fed by hand into bell-shaped holes in a revolving disk. These holes are arranged in radial lines, each line with as many holes as there are nails wanted along the side of a box. This disk revolves and delivers the nails into bent tubes, each nail to a separate tube, which then delivers it to a pair of nippers arranged in a row with others. Upon receiving their nails, the nippers advance simultaneously, so as to bring each its nail under a kind of stationary hammer, the point of the nail protruding below the embrace of the nippers. At this point in the operation, the box, upon a sliding platform, rises until the points of the nails penetrate it to a certain extent, when the nippers relax their hold and recede, the box still rising to receive the entire penetration of the released nails, the stationary hammer acting upon the heads of them meantime. This nails one edge of the box; but all the edges having the same arrangement of nails, are finished by a repetition of the above movements. Then, to do the ends, the boxes are transferred to other machines, or the same one can be readjusted when a sufficient number of boxes have been passed. These machines work with rapidity and precision, not one nail in many thousands failing to enter properly.

Self-feeding nail machines are beginning to occupy the attention of inventors with some degree of success. What are technically known as nails, range from 1½ to 6 inches in length and from 800 down to 10 nails to a pound. But the genus extends upward, under the special name of spikes, to 2 feet or more in length, a single one of which will weigh from 6 to 15 pounds, and downward, under the name of brads, to ¼ inch in length, and to 10,000 to a pound.

Petroleum in Wyoming.

Late newspaper statements confirm the reports that have been made from time to time respecting the discovery of extensive and valuable deposits of petroleum in Sweet Water county, Wyoming Territory. A company has been formed, under the name of the Rocky Mountain Oil Company, which last year made a number of experimental borings, with very encouraging results. The company at the present time have erected reservoirs capable of storing 1,500 barrels of oil per day, and claim that so soon as they are in condition to market the product, they will be able to produce as much as 50,000 barrels per day. At this rate, the Wyoming oil territory bids fair to become in time a powerful rival to Pennsylvania for supplying the markets of the Pacific slope.

The oil of Wyoming is said to be of excellent quality. It is reported that, without refining or preparation, it makes a good lubricating oil, and that it is used for this purpose by the Union Pacific Railroad Company. During the coming summer, we are informed, the oil company will erect a refinery along the line of the Union Pacific Railroad.

Strains on the Shells of Steam Boilers.

BY S. N. HARTWELL.

If it were practicable to construct of suitable materials perfect hollow globes or cylinders of sufficient size for steam boiler shells, the strains to which the material would be subjected when exposed to internal fluid pressure would be comparatively simple. They would not be entirely simple, because the pressure tends to part the material in more than one direction, and in this respect the force differs from the simple or single

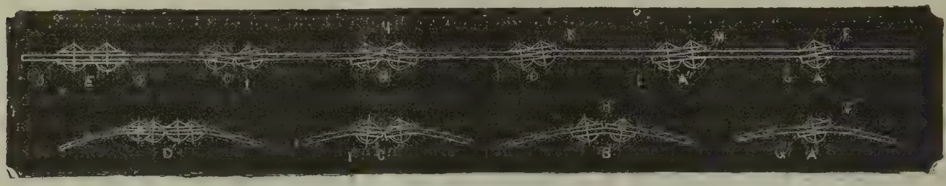


Fig. 1.

one usually employed in testing for its ultimate tensile strength a piece of the metal by pulling it in two in a machine capable also of weighing the force to which it yields.

In the present state of the arts, all forms of boiler shells of considerable size must be made by joining metal plates by means of rivets, and all forms that have a circular section must be made of bent plates. Holes must be made for the rivets, and some form of lapped or butt joint constructed, which involves more or less irregularity of the curves or planes that are joined.

To estimate the strength of a joint made of material of known tensile strength, a calculation is made of the amount of material remaining between the holes, supposing that the resistance of the rivets to shearing preponderates the strength of metal remaining between the holes, and an allowance is made for the effect of the punch on the strength of the metal immediately surrounding the holes. But, for obvious reasons, the result is only approximate. If an attempt is made to burst a shell for the purpose of ascertaining the strength of its joints, they are likely to become so much strained and distorted before breaking, that leaks will prevent the accumulation of sufficient pressure with an inelastic fluid to make a decided test, except of the very weakest part of the structure. Although this is the

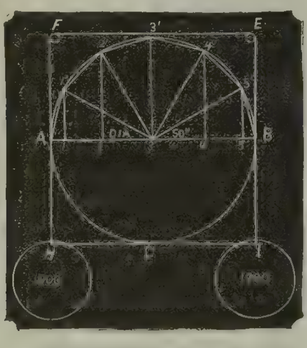


Fig. 2.

real measure of the strength of the structure, still it may be desirable to know the strength of the stronger parts. The best way of ascertaining the relative strength of the several forms of joints, is by testing plane models of each having a number of rivets, by pulling them in two.

When tested in this way, plane models will, before breaking, be distorted (as shown in Fig. 1) more or less, according to the ductility of the metal. If it is pretty brittle, and the rivet heads are strong and sufficient to prevent the bending of the plate on the line of the rivet holes, then the plate will probably break adjacent to the end of its fellow G or F, Fig. 1; or, in case of the single-covered butt, the covering plate will break in the middle, I and H. But should the plates be soft and ductile, or the rivet heads low and insufficient, then the bend and break would occur at the weak line through the holes.

If the plates represented in Fig. 1, A, etc., were straight at the joint, they might, without much stretch of the imagination, be considered a plane drawing of a section of a transverse or circumferential seam of two hollow cylinders. But it is plain that if a force is applied tending to separate two cylinders joined in this manner by pulling lengthwise upon them, the distortion that would happen to the tested plane plates would be resisted by the transverse curvature; and before this distortion could take place in the cylindrical joint, the extreme end of the inner cylinder, L, Fig. 1, must contract in diameter, and the outer one correspondingly expand at its extreme end, M, involving in the inner one a compression or upsetting, and in the outer one a drawing of the metal. The same may be said of all the joints of a globe, if they are properly fitted. If the joint be a butt, with a single outer cover C, a similar contraction must take place at both of the abutting ends and a contraction of the middle of the covering strip, while the converse of these motions would take place in the case of the joint with the inner cover B. It appears clear, therefore, that these distortions are not likely to take place in a *transverse*

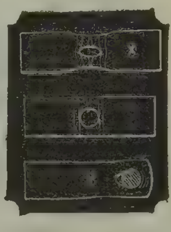
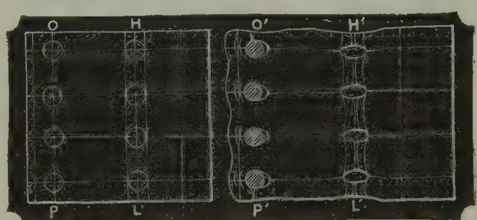


Fig. 3.

seam of a cylindrical boiler shell from the effort of an internal fluid pressure. The butt joint, with two covering plates E would seem to be able to retain its shape when tested in plane form.

In order to illustrate, without mathematics or abstruse physical rules, the fact that the material of a hollow cylinder is affected by internal fluid pressure about the same as though it were a plane and pulled in a straight line parallel to its surface, the diagram, Fig. 2, is here introduced as a simple mechanical study, rather than a conclusive demonstration of the problem. Let the line H, F, E, I represent a flexible band, supported on the frictionless rolls on fixed axles F, E, and loaded with the weights H, I. It appears that all parts of the band are subjected to a tension of 1,000. If, now, the band be supported in the same frictionless manner at the points A, 1′, 2′, 3′, 5′, B, the band will represent the sides A1′, 1′, 2′, etc., of the semi-polygon A, 3′, B, and the tension will be the same as before on all parts of the band, and it will still be so if the number of sides of the figure is indefinitely increased till it becomes a semi-circle. Now let the weights be removed, and the ends of the band be joined



Before Stretching. *After Stretching.*

Fig. 4.

at D, a point in a complete circle, the lower half being in all respects like the upper half. It is a matter of indifference, so far as the band is affected, whether the tension is caused by the weights or by the effort of its supposed frictionless supports to extend radially, therefore if a tension equal to 1,000 is produced by an expansive fluid (which is frictionless practically), so confined within the band, which may be any desirable width, as not to interfere with its freedom in following the direction of the interior force, it will appear that the effect on the band is the same as though it were straight and loaded with weights producing the same amount of tension. It will probably occur to the practical reader that an iron band is not flexible; but a

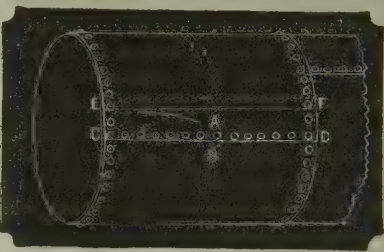


Fig. 5.

little thought will lead to the conclusion that though iron is comparatively stiff, yet the tendency exists the same as though it were flexible, and, so far as the band is overpowered, it is flexible and will yield and assume the forms described. If the force is so great as to overcome the power of the iron to return to the form and size it had before the force was applied, its elasticity is destroyed and a permanent set will occur. This power is generally retained by iron up to about half the breaking tension—that is, half the force that would break it by pulling will destroy its elasticity, and when the force is removed it cannot contract to its original length, as leather or rubber does when stretched.

It has been shown above that the transverse joints of a cylindrical shell are not likely to be distorted to the same degree as joints in plane models, but the behavior of the plane models may (it appears from diagram 2) be accepted as a fair hint at what may be expected of the longitudinal joint of a cylinder when overpowered by an internal fluid pressure. Lapped longitudinal joints are shown at A′, Fig. 1; single riveted and single covered butts at B′ and C′; D′ shows a double-riveted, single-covered butt. Fig. 3 is intended to show the condition of a narrow strip of soft metal, having a hole in the middle, that has been sub-

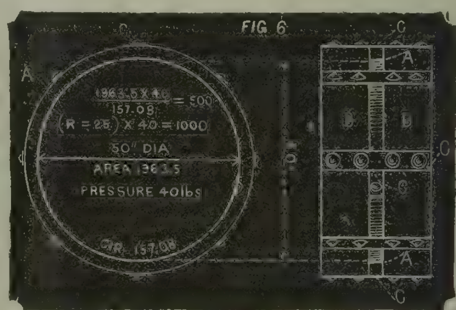


Fig. 6.

jected to simple overpowering strain. The hole that was round has become elongated (lengthwise), and narrowed transversely as the metal yielded; but the holes that have been occupied by rivets, as at Y, Figs. 3 and 4, are distorted in a different manner. Their lateral contraction is prevented by the body of the rivet, and they remain the same breadth as before they were strained; but they are elongated behind the rivet, while the metal before the rivet has been crushed and upset, showing curved wrinkles. In the wide model, Fig. 4, the metal between the second and third holes, L′ H′, would be called upon to yield towards both selvedge holes, and it would therefore be thinned, or else the whole plate must be narrowed on transverse lines touching the holes at their right and left sides. The behavior of the broad model in this respect depends greatly on the ductility of the material and its fibrous or homogeneous character. It is not at all probable, therefore, that a narrow strip gives a fair in-

dex of the strength of a wide model or plate of greater width. It seems clear, however, that the selvedge is the weakest, and the strength of a model of even a dozen holes would not fairly represent a plate bounded by cross seams, thus leaving no selvedge.

Returning now to the consideration of the double-covered butt joint E, Fig. 1, which has been alluded to as apparently able to retain its perfect form under excessive pulling loads. Let us conceive that it is made circular, as the others are in this figure; now, while it does not seem liable to take the distortions here shown, still the irregularity of the interior curved surface will be apparent, and the effort of the internal force being to form the interior surface into a perfect circle, the curve of the plates at the point O O will be somewhat sharpened, in the same way, but very much less than they would be if it were a hoop tightly set upon a solid cylinder of stone or other unyielding material. We are supposing that the tension is caused by the uniform pressure of a fluid, a perfectly mobile body, inside the curve, and though the interior irregularities of the surface indent the fluid, and all inner sides of the irregularities are touched and equally pressed by the fluid, still the tendency is to form them into a resultant arc that would have a different radius from that of the circular axis of bent plates.*

It will be noticed that all the longitudinal joints of a cylinder formed by riveting are affected in the same way, but in different degrees, according to the volume of the inward projections, and that so far as it goes it lessens the distortions of the simple lapped and the single-covered butt joints. Comparing the volume of the inward projecting parts in the single-lapped with those of the double-covered butt joints, we find, for equal thickness of covers and plates, that they are about as 1 to 4 for covers double the width of the lap.

When we study the cylindrical boiler shell made of sections or rings of plates, Fig. 5, and remember that the load from an internal fluid pressure is twice as great upon a band or ring unit A B, as it is upon a stave or longitudinal unit E F, we not only get an explanation of the tendency of all forms not spherical to become so when thus acted on, but we see why it is that cylinders oftenest break or become grooved at the middle of the longitudinal joints. We may be accustomed to think of iron and steel as inelastic in the sense that rubber is elastic, and it is almost so, having but a small degree of that property; but of ductility, which gold and silver have in a high degree, it has considerable, or should have, in order to make it suitable for boiler plates, and it should also possess stiffness enough to enable it to preserve its form against considerable counter loads when not distended and so stiffened by an internal load; but it is very desirable that boiler plates should stretch as well as bend before breaking, and all good plates will do this, especially those of soft, homogeneous steel.

If such material is made into a hollow cylinder and tested by an excessive pressure, it will probably first yield at the middle of the length of a section, as A B, Fig. 5, provided always that the transverse seams are not made the weaker section by punching too large rivet holes or some other malconstruction, and the section will tend to enlarge in the middle and become barrel-shaped, and finally break at the middle of the seam C D, and the reason seems to be, not that there is a greater pressure here at the starting to yield, but that, having started, the diameter is increased and the strain has become actually greater and at the same time the material has become attenuated and less able to resist, and so while the pressure is maintained the weakening goes on in an increasing ratio.

The subject of strains on a hollow cylinder may perhaps be better understood by the help of the diagrams Figs. 5 and 6. Supposing we have a plain hollow cylinder with covered ends of sufficient strength. Let the cylinder be 72 inches long and 50 inches diameter. It may be conceived as composed of 72 ring-units, each 1 inch long, 50 inches diameter; or we may consider it made of stave-units 1 inch wide and 72 inches long, of which latter there will be as many as there are inches in the circumference—namely, 157, or, more exactly, 157.08 (see dotted lines, Fig. 5.) Now, to compare the strain on each ring-unit with those on each stave-unit. Let a model of one of the rings, like an uncut piston ring, be placed water-tight between two immovable heads B B, Fig. 6, and subjected to an internal hydrostatic pressure of 40 pounds to the square inch. The rule for estimating the strain on the ring, is: Multiply the diameter in inches by the pressure in pounds; the product is the force tending to break it into two semi-circles, but there are two sections of the ring resisting this force, therefore one-half is borne by each side. The ring being 1 inch long by 50 in diameter, we have $\frac{40 \times 50}{2} = 1,000$ pounds, the force acting on each side parallel to circumference tending to pull it in two. The simple strain then is 1,000 pounds on the ring-unit. Now, it is evident that the force tending to move the heads B B apart, will be obtained by a different rule, which is: Multiply the area of *one head within the ring* by the pressure per square inch. Now, considering the cylinder made of 157 staves, it is evident that each will resist $^1/_{157}$th of the force. Thus it will be seen, according to the figures in the cut, that each stave is loaded with 500 pounds; and it can be proved in like manner that a ring-unit bears double the load that a stave-unit does in plain cylinders of any size. But the ring-units and the stave-units are one and the same shell, Fig. 5, and the compound strains are apparent, but what effect the 500 pounds per stave-unit has on the tensile strength or the elastic limit of the ring-unit, is a matter of little consequence, except as a scientific fact, and one that would be rather difficult to investigate or determine by experiments of short duration, and it is not worth considering in a properly made steam boiler that has an ample margin for safety. But it may be worth considering in a case where the circumferential tension is nearly up to the estimated elastic limit of the metal. It may have an important influence on the ultimate strength.* Suppose a single-riveted 54-inch shell made of $\frac{1}{4}$-inch plates 40,000 T. S. Estimating the seams at six-10ths the strength of the plates, then about 111 pounds per square inch would reach the estimated elastic limit of that quality of iron. Thus $^6/_{10} \times 40,000 = 24,000$, the ultimate strength of the seam; $\frac{24,000}{2}$ = elastic limit of the seam.

So by the rule $\frac{12,000 \times .25}{27} = 111$, the pressure per square inch which would produce 12,000 pounds per sectional square inch on $\frac{1}{4}$-inch plates in a 54-inch shell. It may be said that the metal between these holes of the seam is not subjected to a longitudinal tension. A double-riveted lapped seam is stronger than a single-riveted one, for this reason, among others, that it is broader and better able to resist the twisting inward at the point A and outward at B, Fig. 5, which must take place when the tension is sufficient to produce the distortion shown at A″, Fig. 1. It is evident, however, that the longer the seam the weaker it will be in this respect. This being so, we may fairly suspect that long longitudinal seams are more liable to be affected by internal grooving than short ones.

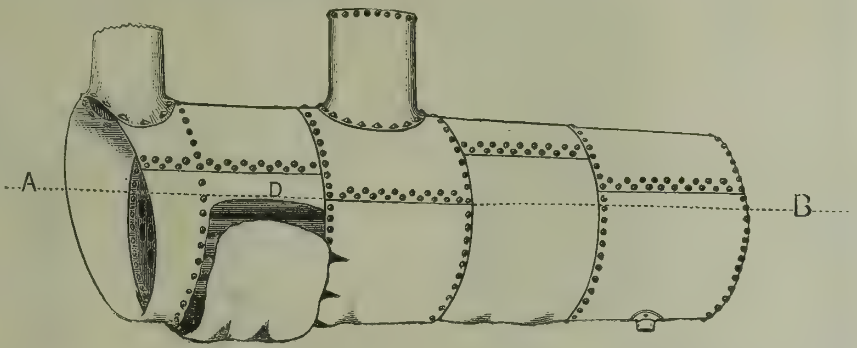
Thus far only the strains on cylindrical forms have been considered.

* The reasoning on which this statement is founded is somewhat analogical. It may not be susceptible of experimental proof, unless an exaggerated model is resorted to, but it is thought by the writer to be worthy of notice in this connection.

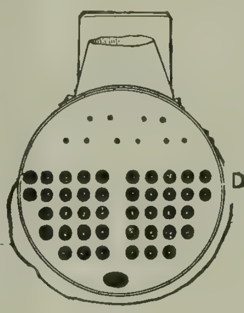
* According to Prof. Rankine, the plane model of a riveted joint may be stronger than one of its members tested separately, on account of the presence of the body of the rivets in the holes of the model, which prevent lateral contraction, Fig. 4. He says (C. E., p. 229, § 154): "If a solid bar has the alteration of its transverse dimensions prevented or resisted by any means, it yields less longitudinally to a longitudinal stress than it does when it is free to yield laterally; in other words, its direct or longitudinal stiffness may be increased. . . . Its strength is increased also."

An Explosion Due to Careless Management.

The following account of the recent explosion of a horizontal tubular boiler, at an extensive rolling-mill, is instructive in that the accident (?) can be so clearly traced to careless management. The facts are reported by one of the inspectors of the Hartford Steam Boiler Inspection and Insurance Co.



Exploded Boiler—Side.



Front.

The boiler was of the horizontal tubular pattern, 5 × 15 feet in dimensions, and, at the time of the explosion, had on about 60 to 65 pounds of steam. The first sheet over the fire gave out on the right side, about midway upon the side, and started about the center of the sheet, ripping across to the girth and head seams, and thence around those seams to a corresponding point on the opposite side. The torn sheet was only opened a few inches from its original position by the explosion, and the boiler remained inside the setting on the ground, the side walls and the front and back plates being thrown over on the floor of the mill. The accompanying cuts are sketches of the exploded boiler, showing the ruptured sheets. The cause of the explosion will appear from the following abstract from the report of one of the Hartford company's inspectors.

From this, it appears that those in charge had several times had low water in this and other boilers in the works, and had also, contrary to directions, blown off their boilers while the brick-work was still intensely hot, thus leaving the boiler, while empty, exposed to the intense heat of the brick-work. Those in charge of the boiler had been repeatedly cautioned against this dangerous practice. An inspection of the sketch shows serious buckling and sagging of the sheets from the intense overheating to which they must have been subjected.

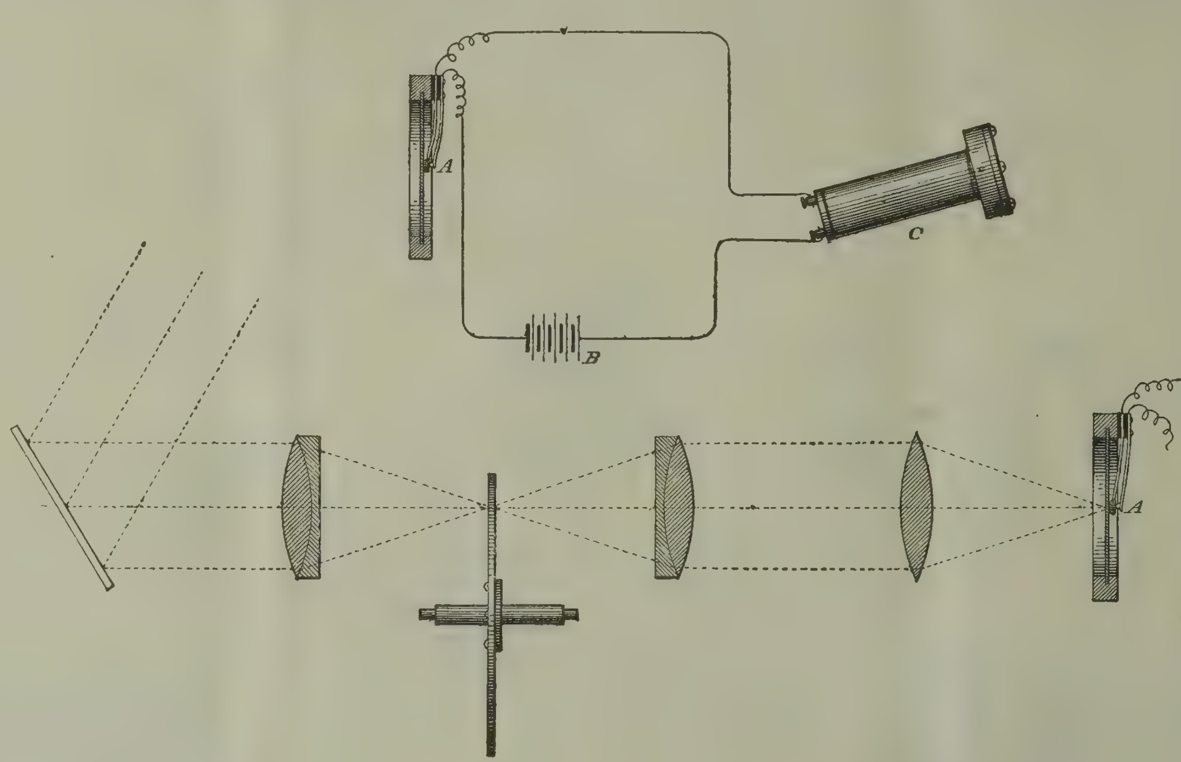
At the moment before the explosion the engine had just been shut down. The explosion, fortunately, was not attended with loss of life, and was manifestly caused by the grossest carelessness.

The Preservative and Antiseptic Action of Salicylic Acid cannot be relied on when brought into contact with any liquid substance in wooden vessels or casks. The salicylic acid under these circumstances speedily disappears, being apparently absorbed and decomposed by the wood tissue. When this acid is used as an addition to drinking-water or wine, the cask must first be coated with pitch.

The Action of an Intermittent Beam of Light on Thin Diaphragms.

In the curious researches in radiant energy made by Messrs. Bell and Taintor, of which we gave a lengthy account in our last issue, there are some phenomena which are difficult of explanation, and concerning which some differences of opinion have arisen between rival investigators in this field.

In seeking for the explanation of the curious sonorous effects produced by the action of the intermittent beam of light upon various substances, notably upon lampblack and other porous, spongy substances, Mr. Bell, considering these materials to be a sort of sponge whose pores are filled with air, supposes that when a beam of light falls upon a surface of such nature, the particles are heated and expand. This causes a contraction of the air spaces among them, and consequently the more or less forcible expulsion of a quantity of air contained in the porous mass. When the light is cut off by the interrupter, the converse process takes place. The particles of the porous mass cool and contract; the air spaces are consequently enlarged, and air is more or less forcibly absorbed, as water would be by a sponge when the prssure of the hand is removed. The energy of this expulsion and absorption of air, and consequently the intensity of the sonorous effect produced, is enhanced by the expansion of the confined air itself when the porous mass is heated by the beam, and by the contraction of the confined air when the porous mass is cooled. By such a process as this, therefore, Mr. Bell conceives that a substance like lampblack can communicate intense sonorous vibrations in the surrounding air, while at the same time it communicates a very feeble vibration to the diaphragm, or solid bed upon which it rests.



This singular fact was also observed by the well-known English electricians, Messrs. Preece and Hughes, who, however, interpreted it differently. They questioned whether, in the Bell and Taintor experiments with thin diaphragms (recorded in our last issue), the sound heard was due to the vibration of the disk, and inclined to the opinion that it was due to the expansion and contraction of the air in contact with the disk confined in the cavity behind the diaphragm. Mr. Preece, indeed, in a paper lately read before the London Royal Society, claimed to have proved that the sonorous effects referred to were wholly due to vibrations of the confined air, and that the *disks do not vibrate at all.*

This is a very nice point to decide, but Mr. Bell adheres to his opinion expressed above, and advances the following reasons for maintaining the correctness of his explanation:

1. When an intermittent beam of sunlight is focussed upon a sheet of hard rubber or other material, a musical tone can be heard, not only by placing the ear immediately behind the part receiving the beam, but by placing it against any portion of the sheet, even though this may be a foot or more from the place acted upon by the light.

2. When the beam is thrown upon the diaphragm of a "Blake transmitter," a loud musical tone is produced by a telephone connected in the same galvanic circuit, with the carbon button A (see subjoined engraving). Good effects are also produced when the carbon button A forms with the battery B a portion of the primary circuit of an induction coil, the telephone C being placed in the secondary circuit. In these cases, the wooden box and mouth-piece of the transmitter are removed, so that no air cavities are left on either side of the diaphragm.

These experiments seem fully to verify Mr. Bell's explanation, that in the cases in question, a real vibration of the diaphragms takes place. He sums up his conclusion therefrom in the following statement: "It is evident, therefore, that in the case of thin disks a real vibration of the diaphragm is caused by the action of the intermittent beam, independently of any expansion and contraction of the air confined in the cavity behind the diaphragm."

Mr. Bell advances other reasons in support of his explanation, but the experimental verification given above we regard as sufficient.

Glucose and Grape Sugar.

Prof. Harvey W. Wiley, in a lengthy article published in the *Popular Science Monthly*, gives some very interesting details respecting the manufacture and uses of glucose and grape sugar, from which we take the following facts:

On August 1, 1880, he reports that there were ten glucose factories in operation in the United States, which consumed daily about 20,000 bushels of corn. The following is a list of these factories and their respective capacities:

Firminich's, Buffalo	4,000 bushels.
Buffalo, "	5,000 "
American, "	3,000 "
Higher, St. Louis	1,000 "
Peoria Refinery, Peoria	2,500 "
Peoria Grape Sugar, "	850 "
Davenport, Davenport, Ia	1,300 "
Freeport, Freeport, Ill	1,500 "
Duryea, Brooklyn	1,500 "
Sagetown, Sagetown, Ill	250 "

At this time (Aug. 1, 1880), Prof. Wiley reports that there were in course of construction nine factories, with a total capacity of 22,000 bushels daily. At the same time, additional machinery was in course of erection in the two Peoria factories, by which their daily capacity would be increased 2,000 and 2,500 bushels respectively. The new factories and their estimated capacity were:

	Capacity.
Detroit	3,000 bushels.
Chicago	10,000 "
Geneva, Ill	1,000 "
Iowa City, Ia	1,500 "
Danville, Ill	1,500 "
Tippecanoe, Ohio	500 "
Rockford, Ill	1,000 "
Pekin, Ill	500 "
Marshalltown, Ia	3,000 "

At the present time, Prof. Wiley thinks it is safe to say that one-half of these new factories are in running order. The total daily consumption of corn, therefore, for sugar and syrup making, he estimates to be about 35,000 bushels. No less than 11,000,000 bushels of corn will be consumed in this industry during the present year; and from the rapid growth of the industry, it appears probable that this consumption will be doubled in 1882. The capital invested in this industry is very considerable. It is estimated that each 1,000 bushels daily capacity represents the investment of $60,000 of capital, which would place the sum actively employed at about $2,500,000. The number of men employed, estimated on the average of 60 per each 1,000 bushels capacity, would be about 2,500. The factories are run day and night.

The word "glucose" is used in the trade in this country to designate the thick syrup that is made from corn starch. The term "grape sugar" is applied to the solid product.

Glucose is chiefly used in the manufacture of table syrups, candies, and for brewing. In smaller quantities, it is used by vinegar makers, tobacconists, wine makers, distillers, mucilage makers, and for other purposes. Grape sugar is used to some extent for the above purposes, but chiefly for the adulteration of other sugars.

The Irish and the Useful Arts.—Irishmen, with all their ability, do not, as a nation, take kindly to industrial arts, nor are they largely endowed with the inventive faculty. After the revocation of the edict of Nantes, some of the industrious exiles, who brought by their industry so much wealth to the countries in which they settled, were driven away from a district in Ireland, where they tried in vain to introduce mechanic arts, by the peasantry. Again, when in the last century 80 acres were selected in Cork for the growth of mulberry trees, with a view to silk culture, the trees grew admirably, and all promised well; but the people could not be induced to prosecute the industry. Trades and manufactures have never been favorites with the Irish. At this date, it is a common saying in Australia that the English trade, the Scotch farm, and the Irish fill the offices. Three of the leading Victorian Ministers, Sir G. C. Duffy, Mr. O'Shaughnessy, and Mr. Higginbotham, are Irishmen.

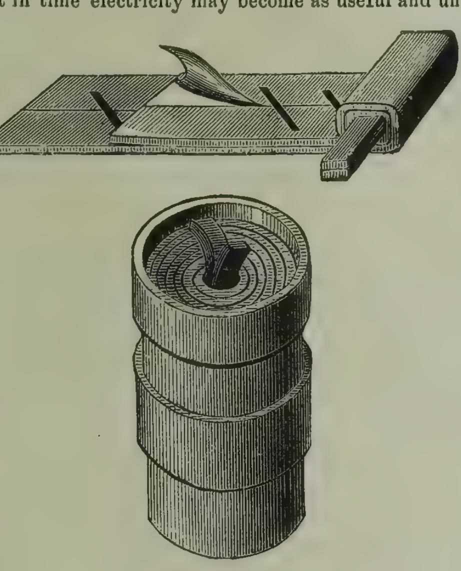
Improvements of the Steam Engine.

Those of you who have been so familiar with the design and construction of steam engines during the past twenty or thirty years, says Prof. Thurston, President of the American Society of Mechanical Engineers, and those of you who have been for a generation past accustomed to handle this miracle of art, will remember, as I remember well, how we learned, at a very early period in our experience, certain cardinal points of practice, which were very strongly impressed upon us. We learned by experience that efficiency was gained only as we learned to handle higher steam with properly adjusted expansion, to work our engines up to higher piston speeds, to cushion heavily when we had large clearance, to reduce that clearance to a minimum, to adjust the size of our engine to its work, and to determine the point of cut-off under proper conditions, otherwise by the governor. We learned that the now well-known "American automatic cut-off engine," with its high steam and moderately large expansion, as exemplified by the "Corliss engine," which is now built all over the world, was the representative of best general practice. But we were not satisfied. Twenty years ago we began to understand that we had yet to perfect the philosophy of the steam engine, and that it was still apparently far from perfect efficiency. We then discovered that while our best engines were consuming from 25 to 30 pounds of dry steam per horse-power per hour, the mechanical equivalent of the heat supplied to the steam in the boiler was sufficient to give about a horse-power per each 2 pounds of high pressure steam per hour, and hence that we were utilizing but one-10th or one-15th of the heat we were paying for when we settled our coal bills. Next, we found that, owing to the fact that we cannot practically expand down to a pressure lower than that due approximately to the temperature of surrounding bodies, that we must therefore discharge heat unutilized; that the larger part of this waste is unavoidable, and that an engine, perfect mechanically, and working within the maximum usually of practicable limits, must waste three-fourths and can return useful effect from but one-fourth of the heat supplied, thus placing the practical limit under known conditions at about 8 or 10 pounds of steam per hour and per horse-power. And here we stand to-day with the steam engine, mechanically almost perfect, yet with a theoretical economy of about 8 or 10 pounds of steam per horse-power per hour while consuming actually, in the best examples, about 15—that is, with an efficiency of 60 or 70 per cent.

In hot-air engines we are not making much more rapid progress, and our field of promise seems to be still in the improvement of the steam engine. We are slowly learning other facts. We know that the great obstacle in the way of attaining nearly theoretical efficiency, is the transfer of heat from the steam to the exhaust side by initial condensation and re-evaporation; we are discovering that high steam and jacketing tend to lose their efficiency at extremely low pressure, with wide ranges of expansion; that it seems possible to reach a point in steam jacketing cylinders at which lower speed may tend to secure sufficient working of the steam; that with well jacketed cylinders we may get good performance, as we to-day judge it, with slow pistons; that we have better work claimed to-day for single than for "compound" engines by 10 or 15 per cent, the minimum yet reached under fair conditions for economy being stated to be by experiment as 1.54 to 1.75, while, assuming the very best conditions for each, it seems certain that both types should give about equally good results. Here is where we stand to-day, and it is from this point that we are to work forward. We need to collect more facts by means of carefully devised experiments like those of Hirn and Hallauer abroad, and of Emery and the Navy Department at home; we need careful and systematic study of the results, and finally the determination of the laws of steam engine efficiency as effected by steam pressure and temperature, rates of expansion and compression, character of steam jackets, rate of piston speed, and every other circumstance influencing economy.

The Faure Secondary Battery.

In a previous issue of this journal, we alluded at some length to the interesting results obtained with the Faure secondary battery in rendering possible the storage of electrical energy in considerable quantity, and its preservation in potential form, without serious waste of energy, for a considerable time, and after the apparatus in which it had been accumulated had been transported from place to place. The possibilities which this interesting result opens, in respect to placing at our disposal electrical energy in more manageable and serviceable form, have awakened decided interest throughout the scientific world. The hope is certainly warranted that in the near future we shall have at command abundant supplies of electricity stored up in apparatus of compact form, upon which to draw for our uses as we may require it; and it does not need much effort of the imagination to perceive that in time electricity may become as useful and universal a servant among civilized people as steam, though it must be confessed that much remains to be accomplished before this state of affairs is reached.



The Faure Battery.

We give in the following a description, with an illustration of the Faure secondary battery, with which the interesting results reported by Sir William Thomson were obtained. The description is abstracted from an ably written article by M. Géraldy in a recent number of *Le Journal Universel d'Electricité*, criticising the comparative merits of the Planté and Faure batteries. The Faure secondary battery is protected by two patents, dated October 20, 1880, and February 9, 1881, respectively. In these patents M. Faure describes principally those batteries composed of lead plates laid on frames covered with red lead, and protected by leather, attached by means of lead rivets, an arrangement similar to the rectangular batteries of M. Planté. The actual batteries are not so made, being constructed as follows: Two sheets of lead are taken, 7.87 inches wide; one of these plates is 23.62 inches long and 0.04 of an inch thick; the other is 15.75 inches long and 0.02 of an inch thick. Each plate is covered on both faces with a layer of red lead reduced to a paste by water, 1.76 pounds being spread over the larger plate, and 1.54 pounds over the smaller. On each face thus prepared a sheet of parchment paper is placed, and the whole is introduced into a sheath of thin leather. One plate is then put on the top of the other and rolled up, strips of rubber being interposed obliquely, as shown in the sketch. The roll is then placed in a cylindrical lead cell, the outside of which is strengthened with copper bands and the inside covered with red lead and leather, so as to increase the useful surface of the battery. The latter then presents the appearance shown in the sketch, and one of the projecting stems from the lead plates is bent over and soldered to the enclosing cylinder, which is ready for use when it has been filled with water and about 10 per cent of sulphuric acid. The apparatus when charged weighs about 20 pounds. It will be seen that this differs from the Planté secondary battery only in the employment of red lead. The material chiefly employed is the same, the mode of construction is similar, the leather taking the part of the cloth previously used by M. Planté; it has no merit in itself; on the contrary, it is a cause of resistance, and is liable to deterioration, being useful only to keep the red lead in place. It is, in fact, this red lead which constitutes the new feature and gives the special advantage to the apparatus.

According to the inventor, there are two advantages gained. The long and delicate operation necessary to prepare the Planté battery is not required. (This operation consists in passing through the battery an electric current, when oxygen goes to one plate and produces a thin coat of peroxide of lead, and hydrogen goes to the other plate). The second advantage claimed is that the battery has a storage capacity much greater than that of Planté, the proportion, according to M. Reynier, being, as deduced from numerous experiments, forty times greater with equal weights of batteries.

The article from which we glean the above description, then proceeds to criticise the relative merits of the Planté and Faure batteries, a subject with which in this place we are not specially interested.

Deaths from Industrial Pursuits.

Some startling facts respecting the amount of sickness and death which result directly from the circumstances under which industrial pursuits are carried on, have lately been discovered in England, where they have been brought to the attention of the authorities as a subject worthy of investigation with the view of amelioration. One statistician who compiled tables on this subject in 1877, giving the records of deaths and injuries by steam boilers, in mines, on railways and in factories, estimated the mortality in England from these causes, during the four years preceding 1877, at a total of 107,000 men, women and children; and he estimated, on the basis of these facts, that 500,000 workmen will lose their lives during the ten years from 1877 to 1886, from the following causes, namely, 300,000 in mines, 70,000 on railways, and 130,000 in factories.

Another writer on the same subject, criticising these figures, thinks they are altogether too small, and that the accidents reported comprise only a small part of those that actually take place. He is of opinion that not less than 100,000 persons are annually killed in England from causes directly resulting from the industrial occupations in which they are engaged.

These statements, which are doubtless based on reasonably accurate data, are sufficiently appalling to arouse from its traditional *sang froid* even so inert and conservative a body as the British House of Lords. Taking even the lowest estimate of mortality from industrial accidents as the safest basis for estimating the number of yearly deaths from such causes the world over, and it will be found that the "horrors" of war, with its reckless sacrifice of human lives, become far less horrible when a comparison of the number of victims is instituted.

Nickel in Norway.—The production of nickel in Norway has become an industry of considerable importance of late years. The first mine was opened in 1846 by an English company, in the valley of Espedel in the mountain district of Soudre Gudbrausdal, but this was closed in 1858 in consequence of the difficulty of approach and the absence of communications. Subsequently to this, mines were opened at Ringerike and Bamble, near Skien, and from 1861–5 there were eleven nickel mines worked, averaging 3,450 tons per annum. In the latter year it rose to 5,200 tons from 14 mines, and increased year by year, until 1875, when it attained its maximum at 34,500 tons. The greater part

of the yield is exported in the shape of ore, Norway being the principal source of the nickel supply, and furnishing one-third of the yield of the world. A part of the ore is smelted near the mines. About 465 workmen are employed in nickel mining, though the number has diminished the last year or two, owing to the lessened demand.

Cotton-Seed Oil.

The production of cotton-seed oil has grown to great proportions in the South. The first efforts to establish this industry were made as long ago as 1832, at Natchez, Miss., but proved unsuccessful, as were also several subsequent attempts. It was first made commercially successful in the year 1855, but the war destroyed this, as it did all other industrial pursuits in the South. Since the war, however, it has been successfully revived. In 1867, there were 7 mills in the country; in 1870, 26; in 1880, 47, which in that year employed 1,525 hands, and whose manufactured products were valued at $2,742,000. At present there are 43 cotton-seed mills in operation in the South.

The total amount of cotton seed crushed yearly in the United States is about 410,000 tons, or 10 per cent of the annual crop. When well stored and properly ventilated, cotton seed keeps sweet for about twelve months; if allowed to become damp, or if stored too long, it spoils, and, by heating, is liable to spontaneous combustion.

When landed at the mill, the seed is freed from dust by shaking it in a screen, and is afterwards blown against a screen to allow heavy bodies to separate from it. It is then freed from adhering cotton by means of gins, and cut up fine in a revolving cylinder supplied with knives; then the kernels are separated from the hulls, which make good food for cattle. The seed is now pressed between rollers, like those of a sugar-mill, the oil running freely from it; then put in woolen bags and placed between horse-hair mats backed with leather having a fluted surface inside, to facilitate the escape of the oil under a hydraulic pressure of 169 tons, to which it is next subjected. The bags are allowed to remain in the press 17 minutes, when all the oil is extracted, the product remaining behind being the solid oil-cake of commerce.

The crude oil is pumped into the oil room, and either barreled direct for shipment or refined by agitation with from 7 to 15 per cent of caustic soda. In the latter case a dark brown substance, known to the trade as "soap stock," is deposited, and the clear oil, amounting to about 82 per cent of the crude commodity, is drawn off into large tanks, where it remains until ready for barreling and shipping. A portion of oil is still obtained from the soap stock by warming, and the latter is sold to the soap makers, or used in the factory for that purpose.

According to the *Oil and Drug News*, from which we have gathered the foregoing facts, the average yield of a ton of seed is as follows:

35 gallons of crude oil, at 30 cts. per gal.	$10 50
22 pounds of cotton, at 8 cts. per lb.	1 76
750 pounds of oil cake, at $20 per ton	7 50
Total yield per ton of seed	$19 76

About 410,000 tons of cotton-seed are annually worked up by the mills, yielding products of the value of seven and a half to eight million dollars, or about 3 per cent of the value of the cotton crop.

The oil is used to some extent in the manufacture of soap, by painters, and for lubricating purposes. Its chief use, however, is as a substitute or adulterant for olive oil, whose place it is rapidly supplanting, and from which it is difficult to detect it by taste or smell. By mixing 75 parts of cotton-seed oil with 25 parts of olive oil a fine table oil is produced; but the substitute frequently contains not a trace of olive oil, but simply a small quantity of some other oil to give it a flavor.

The destination of the oil produced in this country is highly suggestive of the use to which it is put. Of 140,840 barrels, or nearly 6,000,000 gallons, shipped last year from New Orleans, 88 per cent was exported on orders to France and Italy, one-half of this total going to the latter country. The amount exported yearly is more than the entire olive oil product of France, and nearly one-fifth of that of Italy. The United States imports only about one-tenth this amount, getting most probably 75 or 80 per cent of her cotton-seed oil back again, improved by the voyage to and fro across the Atlantic. At least two-thirds of our entire production—15,000,000 gallons—is exported to Europe. The Italian government has lately endeavored to prevent, or check, the very general adulteration of olive oil that is known to be carried on, by imposing a heavy import duty on cotton-seed oil.

The oil cake is highly valued for stock feeding and fertilizing purposes, and commands a ready market.

Comparative Food Value of Rice.

We have met the following scrap of popular science, though we are unable to trace its origin: "It will surprise many to learn that rice has a nutritious percentage of 88, while beef has but 26; still civilized mankind will adhere to the latter with the idea that it has most nourishment. The difference between a pound of rice and a pound of beef is very marked, the former being 100 per cent cheaper and 100 per cent more valuable to the common laborer than the beef diet. There is a lesson of tremendous importance in this fact which should not be overlooked by the laboring classes."

The writer of the foregoing is right in one sense—that is, in his supposition that his remarkable statement will create surprise. The truth is, that rice is one of the most inferior of the cultivated grains in point of nutritive value, standing in this respect below nearly all of them. We give herewith a tabular statement of the nutritive constituents of various foods (excluding water), which will show the inferiority of rice very clearly:

	Beef.	Eggs.	Milk.	Wheat Flour.	Oat Meal.	Rice.	Peas.	Beans.
Fibrin, casein, albumen or glutin (flesh-forming)	89	55	35	12	21	9	28	30
Fat	7	40	24	2½	7	1½	2	..
Starch or sugar (heat producing)	..	..	37	83½	70	88	67	67
Ash or mineral matter (bone forming)	4	5	4	2	2	1½	3	3
Totals	100	100	100	100	100	100	100	100

From the above, it will be seen how absurd is the statement that rice is superior to beef in nutritive value. It is the richest in starch of all the cultivated grains, but this deficiency the others more than make up in their percentage of flesh-forming nitrogenous constituents. In these rice is very poor, standing below wheat and maize, and having less than half the percentage of oats. Peas and beans are by far the most nutritive of the vegetable seeds, and afford the most concentrated form of vegetable nourishment. They are not only rich in starch (or heat-producing) elements, but likewise contain a high percentage of nitrogenous (flesh-forming) elements, and a high percentage of mineral matter. The latter, therefore, should have been selected as the fittest for a comparison in nutritive value to beef. The latter, though containing no starch, contains a fair percentage of its equivalent heat-producing animal element—fat, which is much superior to starch as a heat-producing food. A perfect food should contain a fair proportion of each of these nutritive elements. In this respect, while beef is much superior to rice, it is surpassed by peas, beans, eggs and milk. The roasted "chick pea" of the East is considered to be more capable of sustaining life, weight for weight, than any other kind of food, hence it is preferred by travelers about to cross deserts, as the least bulky and most valuable form of food.

GLUE THAT WILL RESIST WATER, it is said, may be produced by boiling one pound of glue in two quarts of skimmed milk.

Scientific.

THE PRACTICAL VALUE OF SCIENCE.—An orator of the present day, says the *American Journal of Science*, who firmly believes that science is the sublime teacher of all practical knowledge, has beautifully said, in one of his lofty perorations, that "reason, observation and experience constitute the holy trinity of science." Looking over the years which have elapsed since the Middle Ages, the frightful ignorance and superstition of which cover many black pages in history; when all knowledge of a scientific character was held in utter contempt, and only a few out of the many could read or write the English or any other language; when the astrologer took the place of the astronomer, and men, women and children believed in the existence of ghosts, witches, hobgoblins, and saw signs that the world was going to be speedily demolished and turned into a still blacker chaos than their wretched ignorance caused to prevail; when science lay strangled in the cradle and was threatened with instant death if it had the temerity to heave a palpable breath; in looking over the years which have made their circuit and been ushered into the realm of oblivion since then, and marking the progress of science, which was necessarily slow at first, but quickened its march century after century until the nineteenth was reached, when it made a sudden and grand flight upward, it would be amazing indeed if we did not behold the mighty advancement in human affairs with awe and unbounded admiration. When ignorance and superstition covered the brains of men like a black cowl, their reason was obscured and advancement was simply impossible; but when they ceased consulting oracles and having dealings with ghosts and witches, and turned their attention to the study of their surroundings, their wants as well, and how to supply them, a new light illuminated the human brain where formerly only savage instinct dwelt, and man and the world began to improve simultaneously. The knowledge of the engineer opened up canals, river channels, and gave us the railway; and these made inter-state commerce practicable, and now we have international commerce. In order to make the earth yield him a subsistence, man used to sweat and toil and die prematurely from hard work; but since science has given him machinery and all kinds of mechanical appliances, he finds the world to be an Elysium to live in compared with what it used to be. Science has not only enabled him to produce two blades of grass from one and make one bushel of potatoes yield a dozen bushels or more, but it has also brought the very market to his door, as it were; it has given him in geology a sure and eternal guide to all the minerals which the earth holds in its bowels, and has furnished the means of readily extracting the same. All there is of music, art and beauty has been bestowed upon us by this great benefactor of the human race, and its shining genius is immortalized in every step forward that man has taken.

Geology doubtless has been one of the greatest aids to our race in making its marvelous progress, and of it we desire to speak more particularly. Minerals furnish the basis of nearly all the useful arts and manufactures, and had it not been for geology we never would have had any. It made the discovery that mother earth possessed within herself all the minerals of which we know anything—gold, silver, coal, zinc, lead, iron, baryta, ocher, peat, etc., and without all these, or most of them, what would our boasted progress in civilization and the arts be worth? Indeed, it is highly probable that had they remained for ever hidden we would never have acquired the cheerful habit of boasting. Many a fortune has been sunk in searching and experimenting for coal, gold, lead, zinc, iron or other ores, in places where the Pyramids might be looked for with the same chance of success in finding them. Bitter experience has taught many prospectors and miners how indispensable to their success is a knowledge of geology. Late geological studies of the Hoosac Mountain have proved that millions of dol-

lars might have been saved to the State of Massachusetts if like studies had been made before the excavation of the great Hoosac tunnel. It is asserted that enough funds were needlessly expended to pay for a complete topographical, zoölogical, geological and botanical survey of the whole commonwealth, such as no State in the Union now possesses, and such as would for ever put away the danger of similar loss in the future. Geology must determine the cost of production of the precious metals, such as gold and silver, and their probable abundance for centuries to come.

The practical value of science in its various departments is too manifestly great to be ignored by any one interested even in a small way in the grand procession of progress. Americans in particular cannot devote too much attention to the study of it in its various branches, as their national preëminence is due to their intimate and practical knowledge of all really scientific subjects, and it behooves them especially to continue to be the friends and patrons of science.

The Gelatino-Bromido Process in Photography.—The collodion or wet process in photography, although an immense advance in respect to rapidity of operation over the processes of Daguerre and others that had preceded it, was not without its great drawbacks, although in spite of them it maintained its place for nearly thirty years as the best process of negative photography that had been produced. Its use, however, outside of the gallery of the photographer was attended with serious inconveniences on account of the difficulty of transporting the chemicals and apparatus of the dark room in a serviceable condition for outdoor work.

Many efforts have been made since the introduction of the collodion process to prepare sensitive plates in a dry state to avoid these and other difficulties encountered with wet plates. These efforts, at the hands of experts, were measurably successful by the use of collodion combined with albumen, but they were found to be lacking in the great essential of sensitiveness, requiring from five to ten times the length of exposure of the common wet plates.

The adoption at length of gelatine instead of collodion and collodion mixtures as the vehicle for carrying the sensitive salts of silver, solved the problem, and placed at the service of the photographer dry plates, equalling, and even greatly surpassing, in sensitiveness the most sensitive wet collodion plate. By this process, which is called the gelatino-bromide process, and for which the photographic world is indebted to Dr. R. L. Maddox, of London, it is possible to prepare dry plates of the most superlative sensitiveness, and which can be kept for a considerable time, and transported from place to place, without material loss of sensitiveness.

These gelatino-bromide plates, according to Mr. John Corbutt, a well-known photographic expert, are prepared as follows: To a solution of fine gelatine in water, is added bromide of potassium or ammonium; in another portion of water is dissolved nitrate of silver; in a room lighted through dark ruby glass, the solution of silver is added by degrees to the bromide and gelatine, and well stirred. It must be kept in a fluid condition for some hours, at a moderate temperature, and where great sensitiveness is required, from one to four days, or the time may be confined to an hour or two by using a higher degree of heat. It now remains only to free it from the nitrates of potassium or ammonium formed during the making of the emulsion, which is done by pouring the emulsion into a porcelain dish and allowing it to set to a stiff jelly, after which it is broke up, washed in several changes of cold water, drained and remelted for use. The plates are coated and dried, and are then ready for use, and may be kept for any length of time.

This procedure, though announced to the photographic world several years ago, has only lately come to be generally appreciated. At present these plates are coming very generally in use for all classes of work in and out of the studio. They require no preparation, but are ready at any and all times when the operator is prepared to make his exposure. For the traveler and explorer they are invaluable, as they may be prepared in quantity in advance and carried for any length of time without suffering material loss of sensitiveness. They can be prepared of wonderful sensitiveness. Pictures can be taken by them with an exposure of less than the 150th part of a second. They have made it possible to take successive views of objects in rapid motion, which before had been impossible, and have vastly reduced the difficulties and tribulations of operator and subject in the studio. In a word, the gelatino-bromide process has brought the negative process of photography to such a high state of perfection, that little or nothing remains to be accomplished in the art in that direction.

Disappearance of the Larger Animals.—Paris *La Nature*, one of the leading journals devoted to the popularization of natural history, deplores the rapid disappearance and threatened extinction of the larger species of animals the world over. Since man has been their competitor, the progressive diminution in their numbers has been very rapid, and the present age may witness their entire disappearance. The journal notices the fact that since the competition opposed by man, more formidable than any other they have had to meet, many species of the larger animals have already become extinct, and many of those which still have living representatives, are daily diminishing in numbers.

The animals which are unfortunately doomed to speedy destruction, comprise those species which are hunted with profit, or those whose existence is dangerous to that of man. In the struggle they are called upon to sustain for their existence, they labor under the special disadvantages, as compared with smaller animals, that they require abundant supplies of food and that their reproductive powers are greatly inferior.

The writer of the article here referred to, thinks it almost certain to assert that the whales, the cachelots, the morses, certain species of seals, the great white bear of the Arctic regions and the other bears, the large carnivorous cats (lions, tigers, etc.,) the gorillas, the great armadillo, the great ant-eater, the giraffes, the elan, the aurochs, the bison, the elephants, the hippopotamuses, the rhinoceroses, the great kangaroo, the elephantine turtles, the crocodiles, the birds of the ostrich group, the great penguin of the frozen sea, etc., are threatened with the fate that has within a few centuries befallen the enormous epiornis of Madagascar, the gigantic moas of New Zealand, and within less than two centuries the dodo and the giant bird of the Island of Mauritius.

The great flesh-eaters are already fast disappearing before the bullets of ambitious lion and tiger hunters; the whales and other great mammalia are becoming scarce; the largest of the deer family, the elan, is less widely distributed than formerly; the largest of wild cattle, the aurochs, which once ranged over the whole of Europe, is now only found in the forests of Lithuania and Moldavia; the bison no longer covers the prairies with boundless herds; the great armadillo is disappearing from South America, and the great kangaroo from Australia.

The Polyscope and its Uses.—We made brief mention some months ago of the fact that M. Trouve, a French physicist, at a recent scientific gathering in Paris, had performed the curious experiment of illuminating the interior of a fish by means of the electrical apparatus called the Polyscope. A few additional facts respecting this novel device and its uses may be of interest. The polyscope is composed of a series of reflectors, in the focus of which a platinum wire is brought to a white heat by means of a Planté pile. The apparatus is made of various forms, to suit the special purpose for which it is to be used. As will be observed from what follows, it bids fair to become of great importance in surgery. A polyscope of the form designed for introducing in the mouth, when placed therein and the current established, illuminates the whole buccal cavity to such a degree that the teeth become translucent and show the condition of their interior. Another form, placed on the extremity of an oesophageal sound, it is asserted, will light up the stomach and make it transparent.

As above noted, the form of the polyscope is varied to suit the requirements of the surgeon, physician and dentist. The production of heat is avoided as far as possible and reduced to a minimum by employing a very constant current and very fine platinum wires, by which artifice it is affirmed the amount of heat produced is quite trifling. This fact is of special importance, since in surgical operations it permits the apparatus to be brought into close proximity with the part to be examined. Already it is said the polyscope has come to be recognized as a valuable adjunct in facilitating surgical operations, and is stated to have come into very general use. It is employed in the hospitals of Paris, by surgeons, dentists, veterinarians, and others. It has been suggested also for other uses, notably for exploring the interior of cannon, for lighting the interior of powder mills, etc.

In the experiment of illuminating the interior of a living fish, before referred to, the experimenter thrust down the throat of a fish swimming about in an aquarium, a reflector connected by conducting wires with a handle which he held in his hand. The lights were then extinguished, and when the reflector was lighted the entire body of the fish is said to have become so luminous and transparent that its vertebræ could be counted, and all the details of its organism were made visible.

The Ultimate Fate of the World.—Richard A. Proctor, in a recent lecture, said: The age of the earth is placed by some at five hundred millions of years, by others at one hundred million years; and still others, of later time, among them the Duke of Argyll, place it at ten million years. None place it lower than ten millions, knowing what processes have been gone through. Other planets go through the same process. The reason that other planets differ so much from the earth, is that they are in a so much earlier or later stage of existence. The earth must become old. Newton surmised, although he could give no reason for it, that the earth would at one time lose all its water and become perfectly dry. Since then it has been found that Newton was correct.

As the earth keeps cooling it will become porous, and great cavities will be formed in the interior, which will take in the water. It is estimated that this process is now in progress, so far that the water diminishes at about the rate of the thickness of a sheet of writing-paper each year. At this rate, in 6,000,000 years the water will have sunk a mile, and in 15,000,000 years every trace of water will have disappeared from the face of the globe. The nitrogen and oxygen in the atmosphere are also diminishing all the time. It is in an inappreciable degree, but the time will come when the air will be so thin that no creatures we know of could breathe it and live—the time will come when the world cannot support life. That will be the period of old age, and then will come death.

A Lecture Experiment.—A brilliant experiment for presenting to an audience in a lecture-room, a vivid imitation of the aurora, can be performed by the following suggestion of Mr. Ackroyd: As close a representation of the aurora as can be drawn is painted upon a screen (presumably a dark screen), with Balmain's luminous paint, and hung up in the lecture-room, hidden from the view of the audience, until required, by an interposed curtain of dark tissue paper. At the proper time a piece of magnesium wire is burned in front of the painting, still hidden from the audience, and when the tissue paper is withdrawn the effect of the aurora will be found very faithfully reproduced and clearly defined. It remains visible for a long time. Many other curious and instructive experiments can be reproduced by the use of this and similar phosphorescent paints.

Improved Band-Sawing Machines.

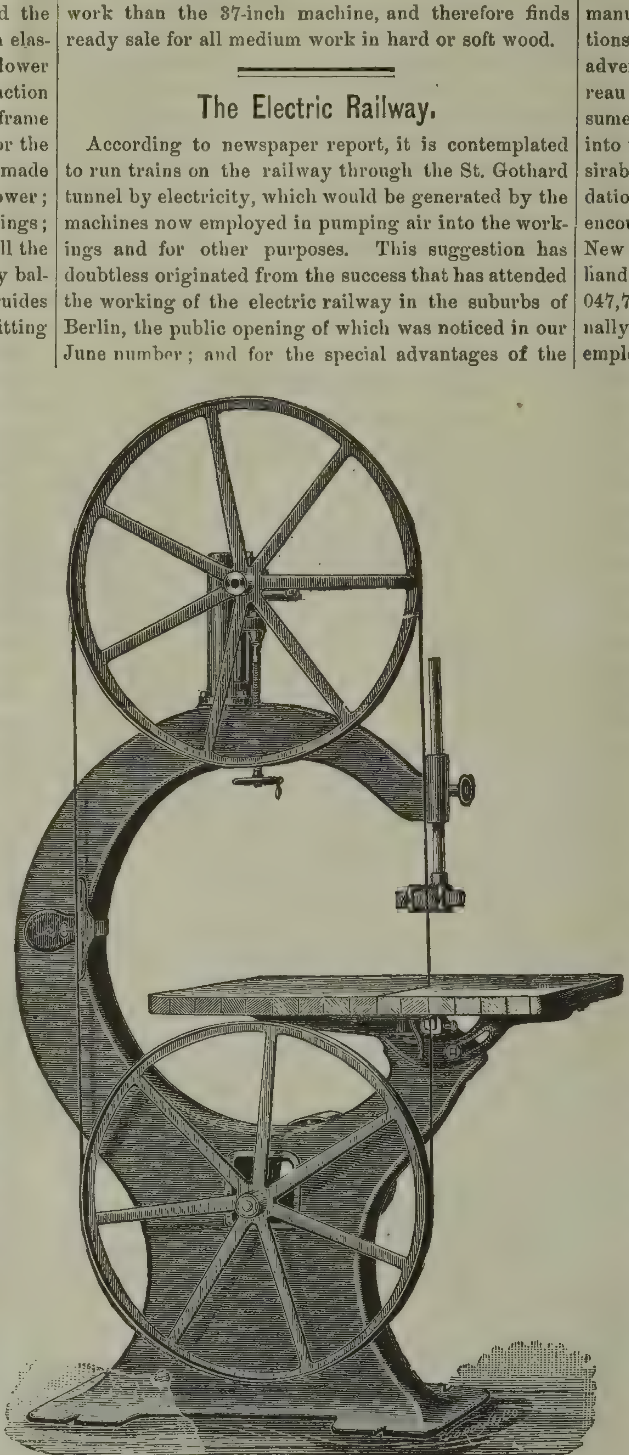
The requirements of a good band-sawing machine demand a frame sufficiently rigid to withstand the strain of the widest blade without springing; an elastic medium somewhere between the upper and lower wheel, to compensate for the expansion and contraction of the blade and counteract the rigidity of the frame and the straining devices; an elastic surface for the blade upon the wheels; hardened steel guides made adjustable in every direction; plenty of belt power; well arranged and properly proportioned bearings; good workmanship, embracing careful fitting of all the wearing parts, wheels turned true and carefully balanced, perfect alignment of the wheels, shafts, guides and table, and an intelligent adaptation of the fitting and the materials to the work to be done.

The above statements are designed to be introductory to a description of the band-sawing machinery manufactured by F. H. Clement, of Rochester, N. Y., and the description, compared with the statement of requirements, will enable our readers to judge of the correctness of the claims put forth by the maker that these machines are good, carefully designed, well fitted, serviceable machines, and as to price, as cheap as the high grade of work put upon them will permit. The Clement works make a specialty of these machines, and manufacture them in large quantities, and with special tools and facilities. None but the best materials are employed in their construction, and these are employed in the best manner that skill and long familiarity with this branch of manufacture can suggest. The machines are provided with extra long bearings of Babbitt metal, so arranged that the wear may be compensated and the shafts kept parallel. They are further provided with canvas-strengthened pure rubber bands for the wheels, stretched on very tight, and turned perfectly true after cementing to the latter. The tables are made of the best kiln-dried cherry, and secured to a heavy tilting-bar in such a manner as to effectively prevent warping. Great care is exercised in securing the accurate alignment of all the working parts, and especially in adjusting the table square with the blade; and the metal is so distributed as to insure sufficient strength to the machine without adding unduly to the weight n parts where lightness is desirable. All these machines are provided with the Clement patent guide spindle and tension device, and are guaranteed by the maker.

Our illustration gives a view of the 32-inch Clement band-sawing machine, which appears to be the most generally serviceable size, and for which there is the largest demand. This machine has a cored frame, cast in one piece; steel shafts; extra long bearings; self-oiling loose pulley; wheels covered with rubber and ground off true; tilting and straining adjustment to upper wheel; heavy table segment, arranged to tilt to an angle; hard wood, kiln-dried table (iron tables when ordered), dressed true and oiled; hardened steel guides, adjustable in every direction, and so arranged that hardwood may be used for side guides if desired; an improved concave arm in the wheels, and patent cushioned straining device and guide spindle. The wheels and pulleys are carefully turned and balanced, and all the parts are true and in line when they leave the factory. There is a sway guide above the main guide (not shown in the cut), also a clamp bar across the table-slit.

The maker calls attention to the fact that this size is heavier than many 36 and 38 inch machines, the frames of which are put together in pieces. Each of these machines is furnished with one first-class blade, joined, scarfing frame, tongs and wrench, the whole packed carefully for shipment. Blades ¾ of an inch wide, No. 22 gauge, may be safely used on it.

This size machine is recommended for pattern, bracket, cabinet, chair, carpenter, carriage, cutter and job shops, and medium work in millwright, car, wagon and agricultural shops. It is better adapted to light work than the 37-inch machine, and therefore finds ready sale for all medium work in hard or soft wood.



CLEMENT 32-INCH BAND-SAWING MACHINE.

The Electric Railway.

According to newspaper report, it is contemplated to run trains on the railway through the St. Gothard tunnel by electricity, which would be generated by the machines now employed in pumping air into the workings and for other purposes. This suggestion has doubtless originated from the success that has attended the working of the electric railway in the suburbs of Berlin, the public opening of which was noticed in our June number; and for the special advantages of the electric system we refer our readers to that article. There appears to be but little doubt that we are on the eve of a decided revolution by the introduction of electricity as the motive power for railway purposes in and about the suburbs of our cities.

Silk Manufacture of the United States.

With a rate of duty ranging from 60 to 120 per cent, there were imported into the United States last year $33,305,460 worth of silk goods of foreign manufacture. This is an increase of nearly $8,000,000 over 1879, and $13,000,000 more than in 1878. It is desirable that the United States should import none but raw silk, if indeed it proved impossible to raise our own silkworms; and the duties have been maintained at their present excessive rates mainly with a view to protect the domestic manufacture. This is conducted chiefly in Connecticut, New York, Massachusetts, Pennsylvania and New Jersey, and has proved very successful as regards certain classes of goods.

A silk manufactory on quite a large scale was established in Baltimore about 1870, but did not prosper, and the enterprise was abandoned. Our present silk manufacture, has attained quite respectable proportions. Gov. McClellan, in his last annual message, in adverting to the work of the New Jersey State Bureau of Labor and Industries, said that his State consumed more than 60 per cent of the raw silk imported into the United States, and that it was eminently desirable to have some action taken upon the recommendation of that bureau in favor of extending special encouragement to the culture of the silk-worm. The New Jersey silk mills give employment to 13,932 hands, to whom they pay wages to the extent of $4,047,745—$300 per capita, which is considered nominally good wages, considering that a good many of the employees are women and children.

The gross value of the manufactured silk product of the United States for the census of 1880, was $40,975,285; the gross value of materials and supplies for this manufacture was $22,371,300; the net value of finished goods was $34,410,463; the number of silk factories in the country was 383; the capital, real and personal, invested in this industry, was $18,899,500; the number of looms at work was 8,467; the maximum number of hands employed during the year was 34,440 (including 9,350 males over 16 years of age, 16,344 females over 15 years old, and 5,005 children and youth), who received $9,107,835 in wages, equal to $264 per capita.

Hydraulic Jacks.

A successful operation has lately been effected by means of hydraulic jacks. The foundations of the lower pillars of the basement of a 60,000-spindle mill at Bolton (England) were lately discovered to have subsided, and the pillar bottoms to have seriously shifted, so much so that the whole of the five floors were ascertained to have settled down to a depth in all of at least 5 inches, owing partly, it is believed, to the presence of a previously unsuspected coal seam. It was found that it would be necessary to raise six of the pillars, and to bottom and concrete the seam of coal, the operation being rendered the more difficult as the weight to be lifted could not be arrived at accurately, the floors of the mill being constructed of wrought iron and concrete, and having arched downward in subsiding. It was, however, estimated that the resistance could not be less than 100 tons upon each pillar. Six 50-ton hydraulic jacks were applied, two to each pillar, and three pillars were lifted at the same time. The work had to be carried on slowly to guard against cracking the floors when raised. The jacks held the enormous weight for about a week in each case, while the foundations were excavated and the concrete put in. The job was successfully carried on, the jacks sustaining the loads without giving way in any degree. Recently, also, a large chimney stack at one of the South Staffordshire iron works having got dangerously out of perpendicular, it was successfully restored, having been sustained by the jacks while the foundations were excavated.

Simple Mode of Toughening Glass.

A Leipsic journal gives a method which it asserts will prevent lamp chimneys from cracking. The treatment will not only render lamp chimneys, tumblers, and like articles more durable, but may be applied with advantage to crockery, stoneware, porcelain, etc. The chimneys, tumblers, etc., are put into a pot filled with cold water, to which some common table salt has been added. The water is well boiled over a fire and then allowed to cool slowly. When the articles are taken out and washed, they will be found to resist afterward any sudden changes of temperature.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 *a* 70 00
Pine, good	55 00 *a* 60 00
Pine, shipping box	20 00 *a* 22 00
Pine, common box	17 00 *a* 18 00
Pine, common box, ⅝	15 00 *a* 16 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 *a* — 50
Pine, tally plank, 1¼, 2d quality	35 *a* 38
Pine, tally plank, 1¼, culls	28 *a* 30
Pine, tally boards, dressed, good	28 *a* 30
Pine, tally boards, dressed, common	25 *a* 28
Pine, tally boards, culls, dressed	22 *a* 25
Pine, strip boards, merchantable	16 *a* 18
Pine, strip boards, clear	22 *a* 25
Pine, strip plank, dressed, clear	33 *a* 35
Spruce boards, dressed	22 *a* 24
Spruce plank, 1¼-inch, dressed	26 *a* 30
Spruce plank, 2-inch	43 *a* — 44
Spruce wall strips	14 *a* — 15
Spruce timber, per M	20 00 *a* 25 00
Hemlock boards, per M	16 00 *a* 18 00
Hemlock joist, 2½x4, each	16 *a* — 17
Hemlock joist, 3x4	18 *a* — 20
Hemlock joist, 4x6	40 *a* — 44
Ash, good, per M	55 00 *a* — —
Oak	60 00 *a* 65 00
Maple culls	25 00 *a* 30 00
Maple good	45 00 *a* 50 00
Chestnut	45 00 *a* 50 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 *a* 40 00
Black walnut, good to choice	90 00 *a* 110 00
Black walnut, ⅝-inch	75 00 *a* 85 00
Black walnut, selected and seasoned	110 00 *a* 150 00
Black walnut counters, per ft	15 *a* 20
Cherry, wide, per M	85 00 *a* 100 00
Cherry, ordinary	60 00 *a* 80 00
White wood, inch	45 00 *a* 50 00
White wood, ⅝-inch	30 00 *a* 35 00
White wood, ⅝ panels	40 00 *a* 45 00
Shingles, extra sawed pine, 18-inch	4 00 *a* 5 00
Shingles, clear sawed pine, 16-inch	3 75 *a* 4 00
Shingles, cypress, 24x6	18 00 *a* 20 00
Shingles, cypress, 20x6	10 00 *a* 12 00
Lath, Cargo rate	1 75 *a* — —
Yellow dressed pine flooring	30 00 *a* 40 00
Yellow pine girders	32 50 *a* 40 00
Locust posts, 8 feet, per inch	18 *a* 20
Locust posts, 10 feet	24 *a* 25
Locust posts, 12 feet	29 *a* 34
Chestnut posts, per ft	3 *a* 3½
Basswood per M	25 00 *a* 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	3 50	*a* 4 00
Up Rivers	7 75	*a* 8 00
Jersey	7 50	*a* 8 00
Haverstraw Bay	7 75	*a* 8 00
" " choice	8 25	*a* — —
Favorite Brands	— —	*a* — —
Hollow Fire-Clay Brick	9 00	*a* 9 25

FRONTS.

Croton—Brown, per M.	10 00 *a* 11 00
" Dark	12 00 *a* 13 00
" Red	12 00 *a* 13 00
Philadelphia	23 00 *a* — —
Trenton	22 00 *a* 23 00
Baltimore	38 00 *a* — —
Clark's Glens Falls, White	23 00 *a* — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1⅜c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	23 50 *a* 24 00
" Glengarnock	22 00 *a* 22 60
" Eglinton	20 50 *a* 21 00
" American, No. 1	23 50 *a* 25 00
" American, No. 2	21 50 *a* 22 50
" American, forge	20 00 *a* 21 00

LEAD—PER 100 POUNDS.

*German	— — *a* — —
*English, common	— — *a* — —
*Spanish	5 75 *a* — —
*Foreign, refined	— — *a* — —
*Bar	6 50 *a* — —
*Sheet	7 50 *a* — —
*Pipe	— — *a* — —
*Domestic	4 63 *a* — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 *a* 3 10
8d and 9d, common	3 25 *a* 3 35
6d and 7d, common	3 50 *a* 3 60
4d and 5d, common	3 75 *a* 3 85
3d and 4d, light	4 50 *a* 4 60
3d, fine	5 25 *a* 5 35
2d, fine	5 25 *a* 5 35
Cut spikes, all sizes	3 25 *a* 3 35
Clinch nails, 1½ to 1¾ inch	5 25 *a* 5 65
do. 2 to 2¼ inch	5 00 *a* 5 35
do. 2½ to 2¾ inch	4 75 *a* 4 85
do. 3 inch and longer	4 50 *a* 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 *a* 6 50
*I. C. coke, 10x14	5 25 *a* 6 00
*I. X. charcoal, 10x14	8 25 *a* 8 37
*I. C. charcoal, 14x20	6 25 *a* 6 50
*I. X. charcoal, 14x20	8 25 *a* 8 37
*I. C. coke, 14x20	5 25 *a* 6 00
*I. C. coke, terne, 14x20	5 00 *a* 5 25
*I. C. charcoal, terne, 14x20	5 25 *a* 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7 *a* — 7¼
Sheet, (open)	— 7½ *a* — 8

SOLDERS.

No. 1	— 12 *a* — 13
No. 2	— 11 *a* — 11½

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 *a* — —
do do No. 1, blue, in rough	— 85 *a* — 95
Bedford Stone	1 25 *a* — —
Berlin Freestone, in rough	— 75 *a* 1 00
Berea Freestone, in rough	— 75 *a* — 00
Brown Stone, Portland, Conn	1 00 *a* 1 35
Bay of Fundy Wood Point Brown Stone	1 00 *a* — —
do Mary Point Brown Stone	1 00 *a* — —
do do Olive Stone	1 00 *a* — —
Brown Stone, Belleville, N. J	1 00 *a* 1 35
Granite, rough	— 60 *a* 1 25
Canaan Marble	1 25 *a* 1 50
Sutherland Falls Marble	1 25 *a* 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 *a* — —

PAINTS.

Carmine, American, per lb. gold	6 00 *a* 6 25
Chalk, per 100 lbs	— 35 *a* — —
China Clay, per ton gold	18 00 *a* 20 00
Chrome yellow, dry, per pound	— 12½ *a* — 28
Lead, red American, per pound	— 6½ *a* — 7
Lead, white American, pure, in oil	— 7½ *a* — 8
Lead, white American, pure, dry	— 6¾ *a* — 7
Lead, white English, pure, in oil gold	— 9½ *a* — 10½
Litharge	— 6½ *a* — 7
Ochre, Fr., dry, per 100 lbs	1 50 *a* — —
Ochre, ground, in oil, per lb	— 6 *a* — 15
Ochre, Vermont, per 100 lbs	— 75 *a* 1 00
Orange Mineral, English gold	— 9 *a* — 10
Paris White, American	— 1⅛ *a* — 1¾
Paris White, English, prime	— 2 *a* — 2¼
Paris Green	— 15 *a* — 28
Plumbago paint, patent, per lb	— — *a* — 25
Putty, per lb	— 2 *a* — 2½
Spanish Brown, dry, per lb	— 1⅛ *a* — 1¼
Spanish Brown, ground in oil, per lb	— 8 *a* — 9
Venetian red, per cwt	1 75 *a* 2 00
Vermilion, Chinese, per lb	— 85 *a* — 90
Vermilion, Trieste	— 70 *a* — 75
Vermilion, quicksilver, bags gold	— 55 *a* —57 ½
Vermilion, American, common	— 15 *a* — 18
Whiting, per 100 lbs	— 60 *a* — 80
Zinc, white American, dry, No. 1	— 5 *a* — 7½
Zinc, white American, No. 1, in oil	— 8 *a* — 10
Zinc, white French, dry, (Red Seal,) gold	— 8¾ *a* — 9
Zinc, white French, in oil gold	— 10 *a* — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 *a* 4 00
Coach Body	2 35 *a* 3 50
do do	1 80 *a* 2 00
Furniture	1 25 *a* 2 50
Black Asphaltum	1 00 *a* 1 50
Brown Japan	1 00 *a* 1 20
Liquid Paint Dryer	1 35 *a* 1 75
Harness, (black)	3 00 *a* 4 50
Shellac, Spirits	3 00 *a* 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 *a* 3 00
Portland (American)	2 25 *a* 2 50
Portland (Lafarge)	3 40 *a* 3 65
Lime of Teil	2 30 *a* 2 50
Lime of Teil, per ton	15 00 *a* 18 00
Roman	2 75 *a* 3 25
Keene's & Martin's, coarse	6 00 *a* 6 50
" fine	10 50 *a* — —
Rosendale	1 25 *a* — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ *a* — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 *a* — —
Goat, " "	— 21 *a* — —

SLATE.

Purple roofing slate, per square	$5 00 *a* 6 25
Green slate	5 00 *a* 6 00
Red slate	9 00 *a* 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 *a* 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 *a* — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 *a* 1 25
Calcined, city casting	1 25 *a* 1 60
Calcined, city superfine	1 50 *a* 1 75

LIME—PER BARREL.

State, common	— 90 *a* — —
" finishing	1 10 *a* — —
Rockland, common, cargo rate	— 90 *a* 1 00
" finishing	1 10 *a* — —
Ground	— 90 *a* 1 00

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 *a* — 28
St. Domingo, crotches, fine	— 20 *a* — 30
St. Domingo, logs, small	— 5 *a* — 8
St. Domingo, logs, large	— 8¾ *a* — 14
Frontera, Mexican, large	— 9 *a* — 12½
Frontera, Mexican, small	— 6 *a* — 8
Other Mexican	— 6 *a* — 12½
Honduras	— 6 *a* — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ *a* — 4½
Rio Janeiro, good to fine	— 5 *a* — 8
Bahia, ordinary to good	— 2½ *a* — 4½
Bahia, good to fine	— 5 *a* — 8
Honduras, per ton	10 00 *a* 20 00
Satin Wood, per foot	— 15 *a* — 75
Tulipwood, per lb	— 6 *a* — 7
Lignumvitæ, large, per ton	30 00 *a* 50 00
Lignumvitæ, other sizes	10 00 *a* 25 00

CEDAR.

Cuba, per superficial foot	— 7 *a* — 11½
Mexican, small	— 7 *a* — 8
Mexican, large	— 9 *a* — 11½
Florida	— 40 *a* — 75

LABOR.

Ordinary, per day	2 00 *a* 2 50
Masons, do	4 00 *a* 4 50
Plasterers, do	4 00 *a* 4 50
Carpenters, do	4 00 *a* 4 50
Plumbers, do	4 00 *a* 4 50
Painters, do	3 00 *a* 3 50
Stone-Setters, do	3 00 *a* 3 50

DRAIN AND SEWER PIPE.

(Delivered on board at New York.)

Discount 50 to 60 per cent, according to quality and size of order.

PIPE, per running foot.

2 inches diameter,	$0 13	10 inches diameter,	$0 70
3 "	0 16	12 "	0 80
4 "	0 20	15 "	1 25
5 "	0 25	18 "	1 60
6 "	0 30	20 "	2 00
7 "	0 35	22 "	2 50
8 "	0 45	24 "	3 00
9 "	0 55		

REVIEW OF THE MARKETS.—In the lumber market the past month business has dropped off somewhat, and trade has lacked the spirit which it developed earlier in the season. With the lighter movement of goods, there were to be found also occasional shadings on values, but the latter were very slight and could hardly be called a sign of positive weakness.

In the brick market, with the exception of a further small advance on values in some cases, the market for common hards has shown essentially the same features noted for some little time back. There has been about the same free, open demand, exhausting the supply as fast as it came to hand, with a few buyers apparently always dissatisfied, while on prices the bids have been full from the outset, and occasionally have worked into an advance where the order was more than ordinarily pressing.

In the cement market demand for both foreign and domestic brands has been good. Supplies have failed to accumulate, and business has been brisk all around.

In the lime market demand has been moderate, and while supplies have not been over-liberal or pressing, the continued dull tone has had its natural influence. Rockland common is, however, the only kind that has shown positive decline.

In the lath market the position remains about the same as at our last writing. There has been found demand enough to exhaust the offering as it came to hand, and buyers are not as yet entirely off the market; but the outlet cannot be called a free one, and a much larger accumulation would be difficult to handle.

In the hardware market there has been an improvement during the month in tone and animation. Mail orders have commenced to come to hand with considerable freedom, a fair number of jobbers are in town, and the wants of local jobbers are on the increase. Under these circumstances, sellers have had quite an advantage, and values have been well maintained, with an inclination shown to increase the line of cost in many instances.

In the paint market the movement of supplies has been moderate, and confined almost entirely to small lots as wanted for immediate and positive consumption.

In the metal markets manufactured iron has had a somewhat irregular market, but the feeling at this writing appears to be of a more cheerful character, and few if any of the leading makers or dealers are willing to modify their ideas on values. American pig has not been very active, and most of the business reported was in the form of small odd lots, required to satisfy some urgent necessity. Scotch pig has shown but little change on the general run of prices, and the market has been if anything a shade steadier for small parcels. Tin in pig has found a somewhat irregular market, and under slow sales buyers were occasionally enabled to secure some odd parcels at a slight fraction off general asking price. Tin plates have had a rather dull and uncertain sale beyond the ordinary jobbing movement, with some fluctuation on values, but not enough to alter the general range to any great extent. Domestic pig lead has found a pretty full outlet, and the general accumulation in first hands has been reduced. Sheet zinc has been in about ordinary demand, and the market has been steady all around.

CEMENT FOR CISTERNS AND TANKS.—A mixture of 4 parts of linseed oil and 8 parts of glue boiled with litharge, is recommended as a good application for making cisterns and tanks water-tight. The mixture should be thickly painted on the inside of the tank or cistern.

Canal Across the Isthmus of Corinth.

An agreement has recently been reached between the Athens government and the eminent engineer, M. De Lesseps, by which the latter undertakes to open a ship canal through the Isthmus of Corinth. Such a water-way would constitute a useful supplement to his Suez achievement, and would go far to cause a complete return of Mediterranean commerce to its ancient channels.

A glance at the map will show that a canal cut across the narrow neck of land which separates the Gulf of Corinth from the Gulf of Athens, would assure a nearly straight course from the Italian harbor of Brindisi to Port Said—the northern entrance of the Suez canal. This would mean a considerable saving of time, even to steamers, which are forced at present to make a long detour around the Morea, while sailing vessels would escape the dangers that, from the most ancient times to our own day, have given notoriety to the cape which forms the southern tip of that peninsula. The rounding of that promontory was deemed, indeed, so difficult and dangerous, that after Brundisium became the entrepot of commerce between Italy and the Levant, it was customary for vessels to be unloaded at Lechæum —the port of Corinth on the Crisean Bay—the goods being then transferred across the narrow isthmus and reshipped at Cenchreæ on the Saronic Gulf. The vessels themselves, when of moderate size, were sometimes hauled across on rollers and re-launched in the waters of the Ægean.

The fact that the Isthmus of Corinth is at the narrowest point only four miles wide, or, if we take a line perhaps more favorable to the construction of a canal, not more than eight, suggested the feasibility of cutting a channel through it from a very early epoch of European history. Owing to their geographical position, the Corinthians were the first of the Greeks in Hellas proper to excel in commerce, and they were prompt to profit by that opening of the Nile to trade. This took place in the seventh century B. C. We may be sure that those Corinthian merchants who had witnessed the great works undertaken by Necho, in the hope of connecting the Red Sea with the Mediterranean, would urge upon their countrymen at home the much more practicable scheme of linking the Crisean Bay to the Saronic Gulf. At all events, the design was more than once seriously discussed during the period of Greek independence, and an attempt to execute it was actually made, in the first century of our era, by Necho. The attempt miscarried, but a careful examination of the ground demonstrates that there is nothing in the topographical conditions to render the task one of insuperable or even remarkable difficulty for modern engineering.

One of the curious results which followed the execution of the Suez canal, was the revival of the long eclipsed and almost forgotten port of Brindisi and its swift approach to the position of preëminence in Mediterranean commerce which it occupied under the Roman empire, and to which it clung as late as the epoch of the crusades. The piercing of the Corinth isthmus would contribute a further impetus to the prosperity of this port, which could hardly fail to gain immensely at the expense of Marseilles, of Genoa, and all its rivals west of the Adriatic. With Trieste, of course, it would not interfere, for the last named haven is the natural point of shipment for that part of central Europe lying east of the Tyrol and of the Elbe. But vessels leaving Trieste, are, of course, as much concerned as those clearing from Brindisi in avoiding the circuitous and hazardous route around the Peloponnesus.

Another interesting effect of the new canal will be the restoration of Corinth to something like its old prosperity. The present town, we should remember, does not occupy the site of the city which was well nigh ruined in the war of independence, and totally destroyed by an earthquake about twenty-three years ago. What is now called Corinth, would remind the observer rather of Lechæum, the northern port of the old eporium, for it lies not midway between the two seas, but near the shore of the Gulf of Lepanto. Even the town destroyed in 1858, which has been the capital of Achaia under the Roman empire, and to whose Christian inhabitants St. Paul addressed his epistles, was not, we need not say, identical in any respect, except in site, with the Corinth famous in the annals of autonomous Greece. The city, which has been the staunch ally of Sparta and the implacable enemy of Athens, was leveled to the ground by Mummius in 146 B.C., and just a century elapsed before its rebuilding was begun. With the exception, however, of this hiatus in its history, its unrivaled situation made Corinth a place of great importance, amid all political vicissitudes, until the trade of Europe with India was transferred to the route around the Cape of Good Hope. It was reserved for M. De Lesseps to undo the work of Vasco da Gama, and his new undertaking is, as we have said, the proper complement to the Suez canal.

How Glucose is Made.

Nearly every one knows that glucose is made from corn, but very few are familiar with the process in detail. The *American Miller* gives the following description of the method of its manufacture: The corn, after being shelled, is carried into large tubs and soaked in hot water from thirty-six hours to four or five days if it is not fermented, or six or seven days of it is, the time depending on the hardness of the corn. If fermentation is not wished, the water is not changed when it begins to sour. It is then ground while wet, with the ordinary burr stones and with a stream of water running into the hopper with the corn. The "chop" is then run on vibratory sieves make of fine silk bolting cloth, with other streams of water added; the finer, starchy part of the corn is washed through the sieves, while the hull, gluten and woody fiber go over the tail of the sieves, and after having the water squeezed from it by rollers, is sold for feed while wet, the water squeezed from the tailings again going on the sieves. The portion that went through the sieves is then run into tanks or tubs, and settled; the water is then drawn off and the sediment again mixed with clean water and treated with alkali, about one pound of caustic soda for each bushel of corn being used, more or less, according to the "hardness" of the water; this is done to separate any trace of gluten from the starch matter. It is then run into long metal-lined troughs or vats, about 8 inches deep, from 15 to 36 inches wide, and, if the building is large enough, 100 to 150 feet long; these descend slightly, and most of the water runs off at the lower end, leaving the sediment at the bottom. In some factories this starch mixture goes direct from the sieves into these metal-lined troughs—"tables," as they are usually called. The sediment is left to settle and dry somewhat in these troughs, and is then shoveled out and known as "green starch," being solid but quite wet, about 50 per cent of it being water. This green starch is mixed again with clean water and made quite thin, when it is run into "converters," though it is usually "washed" and settled several times first. These converters are large wooden tubs or tanks, in which it is treated with acids, sulphuric being mostly used, though muriatic, nitric and even oxalic are used somewhat also. While being thus treated with acids to convert the starch into glucose, it is brought to a boiling point with perforated steam pipes coiled inside the tub, or by other steam jets. Some use "pressure converters," which are iron tanks like a boiler, where the conversion is quicker, being enclosed and under steam pressure. The operator makes frequent chemical tests to determine when the conversion is complete, and when satisfactory the mixture is drawn into another vat or tub, where the acid is neutralized by putting in marble-dust, chalk or fine whiting, or other forms of carbonate of lime or other alkali, for which the acid has a great affinity. Some of the smaller factories, however, neutralize the acids in the converting tubs. It is sometimes then bleached in these converters or in other tubs, by fumes of sulphur first passed through water, the sulphur being burned in a small iron furnace; these fumes of sulphur are also used in cleaning and sweetening tubs, etc. The mixture is now thin glucose liquor or syrup, but is somewhat discolored, and to clear it of impurities, sulphate of lime, excess carbonate of lime, etc., are used, and to whiten and cleanse it, it is run through "bag filters" of cloth or canvas, and then through filters of bone charcoal, sometimes two or three times, these filters being iron tanks about 30 inches in diameter and 8 or 10 feet long, filled with charcoal. The syrup is then drawn into the vacuum pan, which is a large, strong tank or kettle of iron or copper, with steam pipes coiled inside for heating, and from which the air is exhausted, or nearly so, by an air pump. It is here boiled down. The boiling in the vacuum is so that less heat may be used for the evaporating of the water from the syrup, boiling in the open air requiring 212° of heat, while in the vacuum it requires only 100° to 125°, according to the nearness of the vacuum. Boiling at this low temperature is an economy of fuel, but is done principally to keep the syrup as light colored as possible, the higher degree of heat browning it somewhat. After coming from the vacuum pan it is put through a "press filter" (sheets of metal with cloth between), and sometimes through bag filters and bone charcoal filters again.

Clark's Metallic Venetian Blinds.

Messrs. Clark, Bunnett & Co., whose fire and burglar proof revolving steel shutters have come into such general use here and abroad, announce that they have lately made several important improvements in the manufacture of their metallic Venetian blinds, which, they claim, render them very durable and highly satisfactory. These blinds are intended for inside use, and are practically indestructible. They are highly ornamental in appearance, and occupy but half the space of the usual window blind. They admit of the light being regulated at pleasure, are readily put up, and require no boxing overhead, grooves at sides or alteration of window-frame. The laths are enameled by special process to any tint, and when dirty can easily be cleaned with soap and water.

The revolving steel shutters manufactured by this firm have come into very general use. We are advised by the firm that they have lately fitted their shutters to the New York Stock Exchange; the large, new up-town buildings of Arnold, Constable & Co.; the Liverpool & London & Globe Insurance Co.'s new building, Astor Library, Marquand Building, and numerous other prominent buildings in New York; besides having shipped large orders to the "Hall of Records," Sacramento, Cal.; Court House, Franklin, Ind.; Cincinnati, O.; Davenport, Ia.; Hudson Bay Co.'s storehouses, Winnepeg, Manitoba, and other places.

A memorandum received from the London house of the firm advises us that their revolving shutters have been crowned with the highest award at the late International Exhibition in Melbourne, and that they are being extensively introduced into prominent buildings in England and on the continent. They are at present being fitted up as fire-proof divisions at the great drapery establishment, in the Louvre, Paris, and at eleven railway stations on the Anvers and Calais line, also in the public markets at Ashton-under-Lyne and Southport, and the Spanish markets at Granada and Antequera, these latter covering 31,700 superficial feet.

The manufacturers are Clark, Bunnett & Co. (limited) 162 and 164 West 27th street, New York.

Cutting Holes in Glass.—The firm of Richter & Co. in Chemnitz, have found a way of so impregnating thin German silver disks (15 to 25 mm. diameter) with diamond, that, when fitted to a quickly rotating tool, these cut through glass or porcelain in a few seconds, or effect any desired carving with great accuracy. With cylinders made on the same principle, round holes can be quickly and exactly made. The wear of the implement, even after much use, is hardly perceptible.

Home Department.

The Induction Balance as a Bullet-Finder.

Considerable interest has been felt in the proposal made by several gentlemen well known in the scientific world to locate the position of the bullet that struck down the President, by delicate electrical apparatus. The form of induction balance devised by Prof. Hughes, an exceedingly delicate electrical instrument for detecting the presence of metallic substances, has been suggested for this purpose, and it appears probable that it could be so used in many cases with success.

This instrument consists of two short glass cylinders, around each of which are wound two parallel coils of fine insulated copper wire. One coil of each pair is included in a battery circuit, in which there is a clock microphone. The other pair is placed in a closed circuit with a receiving telephone. The two glass cylinders, with their encircling coils, may be widely separated. The induction set up in the secondary or telephone circuit is balanced by the reversal of one of the secondary coils, and so adjusted that the induction in one of the secondary coils exactly balances or neutralizes the induction in the other, so that when the ear is applied to the receiving telephone no sound is heard. If, however, a fragment of metal, no matter how minute, is placed in one of the glass cylinders, its presence destroys the electrical balance, and the fact is indicated by the loud ticking of the clock on the microphone. The same result will be observed if the coil is placed in the neighborhood of a piece of metal.

Mr. George M. Hopkins, to whom the idea occurred of using this instrument as a bullet-finder, at once tried the experiment of noting the effect of a leaden ball in the instrument, placing the bullet at different distances, and separating it from the coil by insulating substances. The experiment, however, failed at first to give satisfactory results, and for the reason that the metal lead produces the least effect on the instrument, and requires a very strong current to obtain notable results. As a strong current burned the carbon of the microphone, it was found necessary to use a current interrupter operated by a clock which interrupted the current at regular intervals. With this current breaker, Mr. Hopkins announces that he has obtained results that surpassed his expectations, as he was able, with a set of coils that were by no means sensitive, to locate the leaden ball with the coils raised a vertical distance of nearly two inches.

Encouraged by the very satisfactory nature of his trial, Mr. Hopkins wrote to the President's private secretary, suggesting that his apparatus might be used successfully in locating the position and depth of the bullet in the President's body, respecting the position of which the physicians in attendance upon him are known to entertain diverse opinions, and which a sudden crisis in the patient's condition may render it highly important to verify. The instrument was sent to Washington by request, but at the time of this writing it had not been used.

Mr. Hopkins states positively that if the missile were of iron or steel, there would be no difficulty experienced in locating it at a depth of even four or five inches; but being of lead, he thinks it doubtful if it would disturb the electrical balance if it is located at a greater depth than two inches from the surface of the body.

Fig. 2 shows the apparatus properly connected and in the act of being used to locate a bullet. The diagram, Fig. 1, shows the arrangement of battery, microphone, and primary and secondary circuit wires. The battery and microphone are in a closed circuit with the coils A A, and the coils B C are in a closed circuit with the telephone receiver E. One of the secondary coils B C is reversed, so that the electrical pulsations induced in the one secondary coil by one of the primary coils A, is exactly counterbalanced or neutralized by the opposing current induced in the other secondary coil by its primary A. Now, by placing a piece (D) of any metal in or near one of these pairs of coils, the

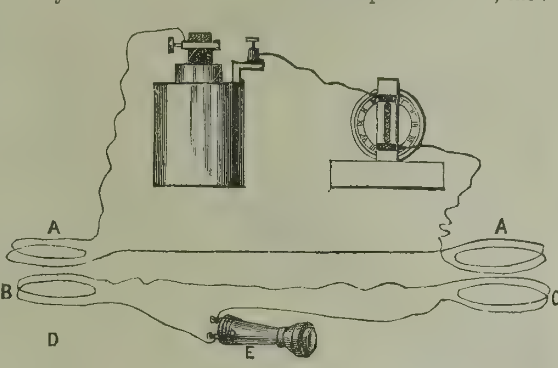


Fig. 1.—Diagram Showing Circuits of the Induction Balance.

electrical balance is destroyed, and the preponderating current produces audible effects in the telephone.

Whether this apparatus should be used in the President's case or not, the suggestion is a most interesting one in the direction of extending the application of electricity in surgery.

Since writing the above, the gratifying intelligence

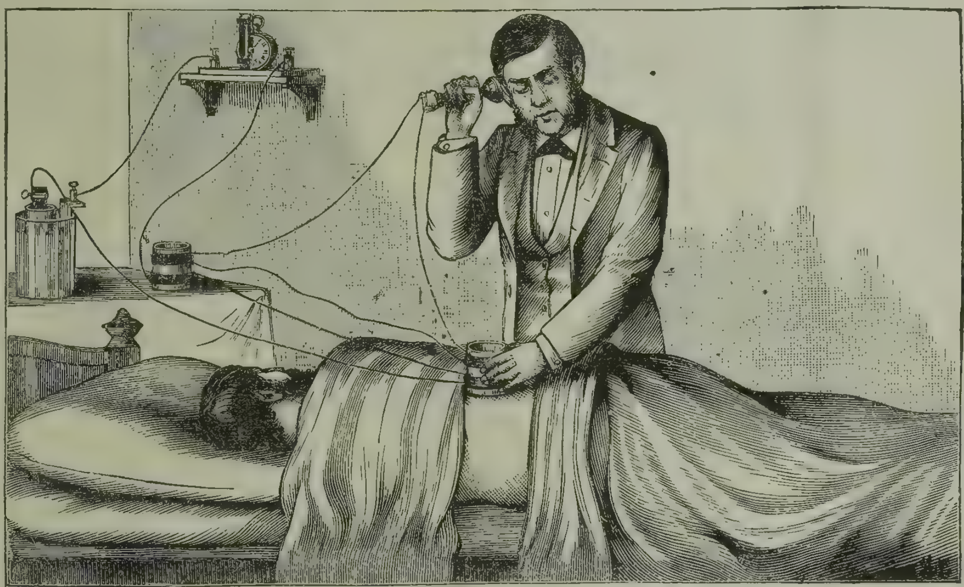


Fig. 2.—The Induction Balance Used as a Bullet-Finder.

has been announced that, at the hands of Prof. Bell and his assistant, Mr. Taintor, a modified form of the apparatus above described, had been used in locating the bullet in the President's wound, and with very satisfactory results. Our space this month will not permit us to give an extended description of the apparatus employed, which we shall reserve for our next issue. It must suffice us now to simply state, that, as the result of many experimental tests, an exceedingly delicate arrangement was finally made, with which the location of the bullet was determined within a very circumscribed area, the result fully justifying the conclusions previously reached by the physicians and surgeons in charge of the case. The only question now in doubt is the depth at which the bullet lies beneath the surface; and this fact, which may become an important element in the future treatment of the President's case should complications ensue which would make the removal of the ball a necessity for the recovery of the patient, has not been determined with accuracy. The accurate determination of this fact depends upon whether the ball has retained its normal shape, or whether it has been flattened in its passage into the President's body by striking the rib which it fractured. Tests showed that a bullet like the one in question gave no effect at a greater depth than $2\frac{1}{2}$ inches, while the bullet flattened gave indications at a depth of 5 inches.

The Odograph.

An instrument called the odograph, the invention of a Mr. Morey, has called attention to the question of high or low heels for boots and shoes. The instrument is intended to register the length and frequency of the step, and consists of a small cylinder, which rotates by means of clock-work in its interior, and a pen which registers on the cylinder a mark corresponding to the step, the pen being raised or lowered at each movement of the foot by the impulse communicated by a small bulb of air beneath the sole.

Having attached the new invention to the feet of several young soldiers, careful observation developed the following facts: In going up an incline, the step is longer than in descending a hill. When a burden is carried, the step shortens. With high heels, the step is short; with low heels it is long. Thick soles, and those prolonged a little beyond the foot, increase the length, while short and flexible soles diminish the reach of the step. A proportion always exists between the length and frequency of the step when walking on level ground. In going up hill the length increases, but the frequency decreases. In coming down an incline the reverse is true. High heels especially, and short soles in a lesser degree, tend to a tottering and irregular walk, and frequent pauses for rest. This is because nature's law, that the whole foot must equally support the body is entirely disregarded, and the whole weight thrown forward, compelling a person from the waist up to bend over the toes in order to keep the center of gravity over its base. Hence with high heels came what is commonly called the "Grecian Bend," the "Providence Dip," and other equally ridiculous and unnatural modes of tottering. No professional pedestrian would be foolhardy enough to undertake to walk for a wager in other than low heels and broad, prolonged soles. No amateur would possess so little sense as to undertake a walk in the country in a high-heeled or tight-fitting foot covering. Yet until recently the dictates of fashion have been such that a high heel, set well under the center of the foot, entailing leg weariness, irregular steps, a staggering walk and frequent pauses, has been the only correct thing in which a lady could encase her foot. Without a good shaped low heel boot, no lady, however pretty her foot or graceful her carriage, can walk becomingly with ease, or give a proper flexion to the muscles of the feet and legs.

Physicians assert that more than one-half the weak ankles, corns, bunions and other imperfections and diseases of the feet and legs, are directly attributable to heels being too high to form a steady base for the weight of the body, and the toes too pointed to allow the proper expansion and use of the feet. Scientific observation, as evidenced by the odograph, also condemns tight-fitting boots and high heels, and demonstrates by practical experiments that the heel can, with benefit to the health and graceful carriage of the

whole body, be almost indefinitely lowered, and that absolutely rigid soles, or those prolonged beyond a certain limit, are disadvantageous. Both medicine and science condemning the same style, it is to be hoped that hereafter the votaries of fashion will remember that the legs and feet were given us to exercise the body upon, and that they can do the human race no greater favor than to forever frown upon anything in the shape of foot gear that does not possess the common-sense elements of low heels, broad soles and comfortable, rounded toes.

The New England Manufacturers' and Mechanics' Institute.

We have already described at length in our issues for May and June, the scope and plans of the New England Manufacturers' and Mechanics' Institute of Boston. Our readers are, therefore, fully informed regarding its objects and the splendid benefits the industries of the country are to receive through the enterprise of New England manufacturers. We gave in our May issue the details of the exhibition building. For a structure of this character, carrying so much dead weight by reason of large expanse of roof and heavy machinery on floors, the most important requisite is of course substantial construction. The building was erected with this fact most prominently in view, and the result has been an absolutely safe structure, and it may be said with truthfulness that there has never been a building erected in Boston where so much care and pains have been paid regarding strength and safety as in this. In the first place a healthy location was selected and the building placed upon a natural gravel bed, over which is a clean, salt marsh, entirely free from pollutions from sewerage or other causes. All specifications and plans were submitted to competent experts before making contracts. Every means were employed to ascertain the best and safest modes of construction, and the work entrusted to experienced mechanics, under honest and faithful supervision. In every part and member of the structure, the engineers having the work under supervision carefully estimated the greatest load that could possibly come on the roofs and floors, and provided material and forms of construction that will withstand four times the load in the iron work, and six times the load in the wood work, without yielding. For instance, take one of the large iron columns that support the main roof and portions of the gallery floor. The engineers estimate the maximum load as follows:

Dead weight of roof and floors	113,997 lbs.
Greatest pressure of wind and snow combined	93,337 "
Greatest live load on floors (dense crowd)	81,900 "
Total maximum load	289,234 "

It is hardly within the range of possibilities that all these maximum forces should be in operation simultaneously; nevertheless, it was assumed to be so, and iron enough was provided in the post, and a form of construction adopted, that would withstand four times these combined forces before yielding.

In recognition of the grand work accomplished by the managers and projectors of the institute, the Boston Merchants' Association has issued the following invitation to a special excursion dinner, showing the cordial and warm support the enterprise has met with at the hands of the business interests of Boston:

"The public spirit evinced by the managers and projectors of the New England Manufacturers' and Mechanics' Institute Fair, has been such that merits especial recognition at the hands of the association. They have given liberally of their means and time without the hope of any direct benefit to themselves, and their devotion to the industries of New England and the business interests of Boston, alone led them to embark in this great public enterprise. The committee believe that it would greatly please members to have an opportunity to show their appreciation of such public spirit, which cannot fail to be of great public good, and they have accordingly arranged for a complimentary excursion dinner, to be extended to the managers of the institution referred to, on Friday, August 19th. The start will be from Foster's Wharf, Atlantic avenue, at 10.30 A.M., thence down the harbor for a sail, later to the new Ocean Pier, thence by special train to the Point of Pines, where dinner will be served, thence by special train, between 6 and 7 P.M., to Boston. The special guests of the association on the occasion will also include the governors of the New England States, who will be in town to attend the opening of the Fair, which occurs on the day preceding the excursion, and Gov. Long. It is possible, also, that other distinguished gentlemen will be among the guests of the association.

"It is the wish of many members that the more social character of the association should be developed; accordingly, on this occasion the privileges of the association are extended to the families of the members, and the committee ask the active coöperation of the members to make this experiment a success. Every provision will be made by the committee to make this first excursion dinner one that shall be enjoyable to all, and a credit to the association. To that end they rely, as in the past, upon the hearty coöperation of members. In order to complete arrangements with the steamboat, pier, railroads and hotel, the committee have decided that no application for tickets will be received after August 12th. Tickets for the excursion dinner are $4 for each person. Messrs. Herbert Radclyffe, C. U. Thomas, A. Shuman, Charles B. Gookin and Charles T. Barry are Committee on Entertainment."

A Silk Fair in Philadelphia.

The Women's Silk Culture Association of the United States is doing excellent work in its efforts to domesticate the culture of silk as a home industry in this country. The society, though its existence is spanned by the brief period of one year, has found such widespread interest in its work throughout the country, and its efforts so heartily seconded, that it has sprung almost from the start into the condition of a vigorous and self-supporting institution.

In furtherance of its objects, the society proposes to hold an exhibition in Philadelphia—the headquarters of the parent society—representing the state of the culture and manufacture of silk in the United States. The officers of the society have issued their prospectus inviting the cordial support of manufacturers. The exact date of the opening of the proposed fair has not yet been announced, but it will be somewhere between the middle of October and the first week of November of this year. To manufacturers and dealers in American silks, no such opportunity has ever been offered as this now made by the Women's Silk Culture Association of the United States. It is desired and anticipated that any hand machines or looms, etc., such as could be placed in the limits allowed, will also be exhibited. It is intended to add to this exhibit all and every description of embroidery and painting on silk from the schools of design, and to make this exhibit one such as was never before presented to the public.

Miscellaneous and Advertising.

Design for Cottage Residence.

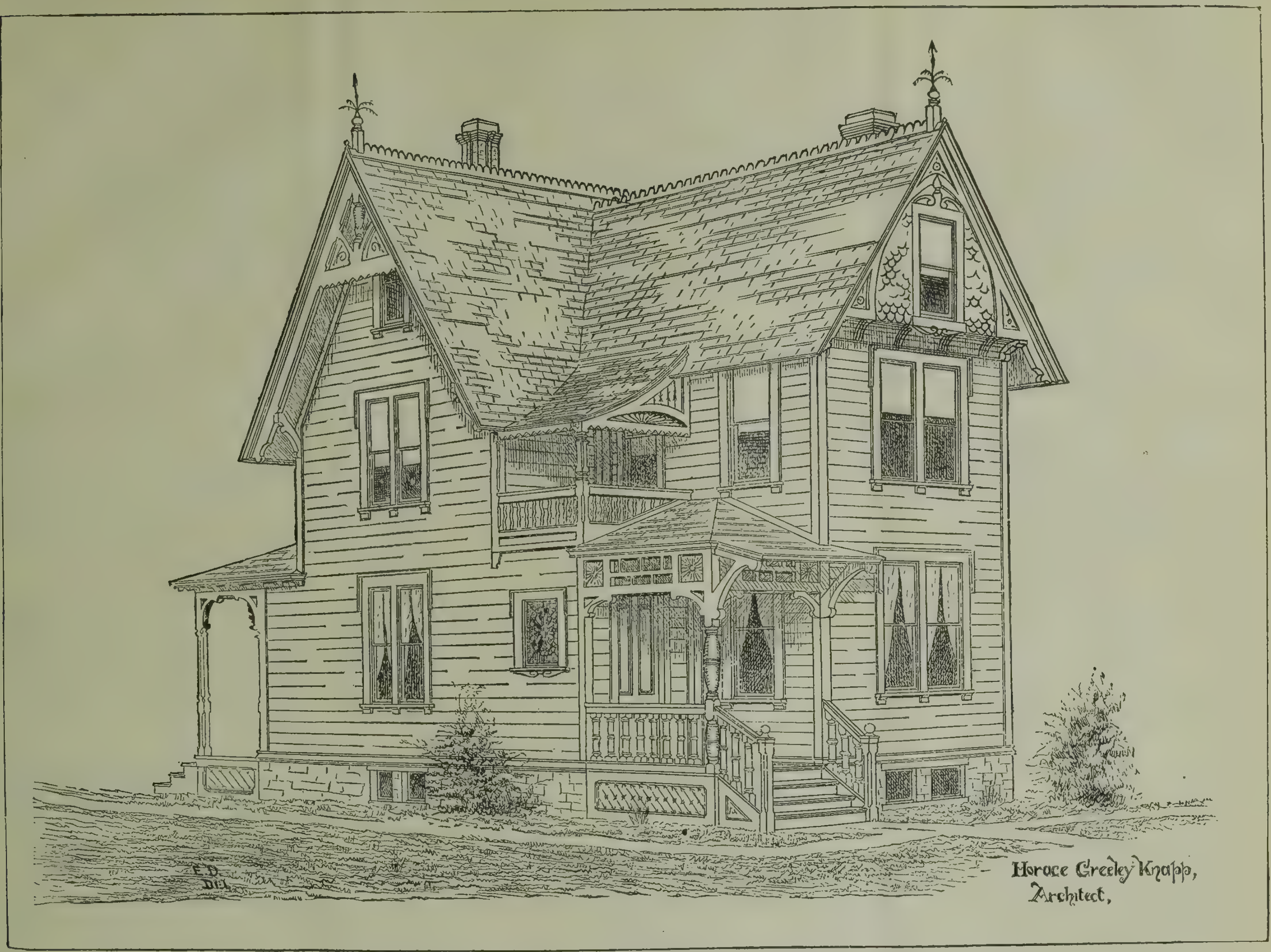
COST OF CONSTRUCTION, $1,500.

There is no class of buildings for which a more widespread demand exists, than that grade of cottages of which the design on the opposite page is an admirable specimen. It is a model suburban dwelling for a small family of culture and refinement, but of limited means, and it will meet with great favor among those who, engrossed in their daily cares and laboring under exorbitant city rents, have almost despaired of owning an elegant home of their own amid the rural attractions of the suburbs of our metropolis.

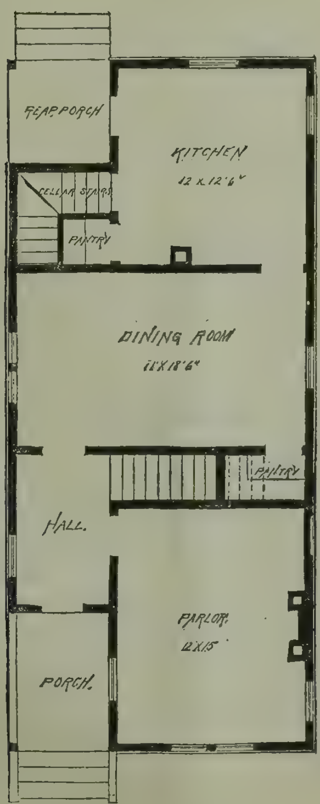
This cottage can be built upon a 25-foot lot, and yet it possesses all the spaciousness that could be desired. The conveniences, it will be noticed, are by no means stinted, and the whole internal arrangement is most carefully studied.

On the first floor there is a parlor 12 by 15 feet; dining-room, 11 by 18 feet 6 inches; and kitchen, 12 by 12 feet 6 inches. On the second floor are three chambers of the following respective dimensions: 12 by 15 feet; 9 by 13 feet 6 inches; and 8 feet 6 inches by 14 feet. There is a porch front and rear, while off the main bedroom is a cosy balcony.

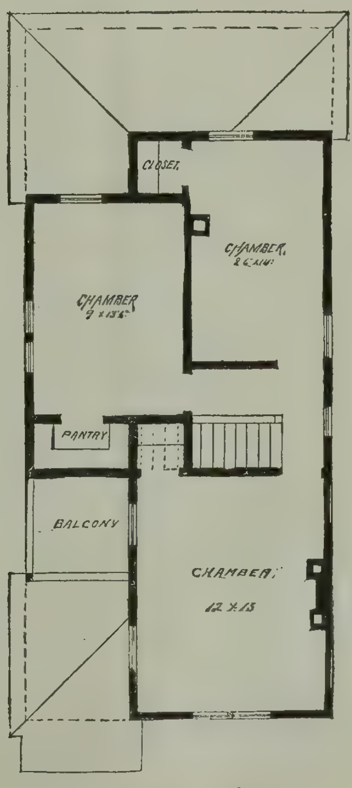
The construction of this house is of the most thorough, workmanlike and substantial character, and is under contract, under the architect's management, for $1,500, Mr. Horace Greeley Knapp, of 61 Broadway, New York, being the architect.



DESIGN FOR COTTAGE RESIDENCE, COSTING $1,500.



First-Floor Plan.



Second-Floor Plan.

Jute.

The amount paid for jute imported into the United States in 1873, was $4,500,000; in 1880, for the year ending June 30, it was $7,000,000, and for 1881 it will probably exceed $10,000,000. Jute is an annual plant of the order *liliaceæ*, and of the genus *corchorus capsularis*. Its stem is from one-half inch to one inch in diameter, grows to the hight of ten or twelve feet, is very straight, and branches out only at the top. It has sharply serrated, lanceolated leaves, about six inches long and nearly two inches wide. The flowers have five sepals and five petals. The stamens are numerous, but they have only one pistil. The bark is fibrous, like that of hemp or flax, and it is the fiber that is used. It is more soft and silky than either flax or hemp, and is very fine—that is, capable of minute division; and its being so fine and of such great length, causes it to be sometimes woven with silk in cheap fabrics. The seed is sown from April to June, and it may be cut in June, July and August. It is best to cut it when it begins to blossom, as the fiber is then better than when the plant is older. After being cut, the stems are steeped in water until the fiber separates easily from the stems. It is then prepared for the loom in a manner similar to that in which flax is prepared, only the stems are not dried and broken, as are the flax stems. In Egypt and Syria the *corchorus olitorius* is cultivated as a pot herb. The American linden or basswood, sometimes called "linn wood," is the most familiar representative of the order to which jute belongs, and the renowned honey of Lithuania is made from linden blossoms, and the highly prized Western honey comes from apiaries which are located near the great basswood forests in the West.

Jute is used to make coarse cloth, mattings, cheap carpets, burlaps, coarse bagging, gunny, rice bags, coffee sacks, and like articles. It is not good for ropes, as it cannot stand the weather; yet our hemp ropes are frequently adulterated with jute. When the "waterfall" for the head was in fashion, many were the switches which were made of jute, instead of flax, as was then said.

Gunny is the name of the coarse cloth used to bale cotton. The yield of this year's cotton is set down at 6,000,000 to 6,250,000 bales. Each bale takes about 7 yards of gunny, hence 6,000,000 bales of cotton alone require 42,000,000 yards of cloth made from the fiber of the jute plant. This is one item, and the largest, but to it we must add the bagging for the increasing rice crop, and for wheat and coffee and pepper, until the whole catalogue is filled.

From experiments in jute culture in different parts of the United States, there is no doubt but that we could supply this demand, and find it a very profitable crop. It is a settled fact that in many of the Southern States we have splendid jute-growing lands. From Virginia to the Gulf it can be grown to perhaps a greater profit than any other crop. California, realizing the benefit of its culture, has been bagging her own products from her own soil for several years. Any portion of Virginia adapted to cotton would grow the jute plant successfully; it has succeeded wherever it has been tried in Virginia, North Carolina, and further South. It can be raised with less labor than is required for corn, and the time for harvesting comes when the planter can harvest it with very little interference with other crops. We hope to see our farmers give it a fair test. Mr. F. M. Elphinstone, of West Point, Va., has given considerable attention to jute culture, and proposes to engage in it extensively in the future.

Ninth Industrial Exhibition at Cincinnati.

We have received a very tasteful and ornamental circular, issued by the commissioners of the Cincinnati Industrial Exposition, announcing that the ninth exhibition will be opened in that city on September 7th, closing on October 8th following.

The annual Cincinnati exhibitions have been uniformly excellent in character, and by reason of good management, have been very successful in commanding the attention and confidence of manufacturers from every quarter of the country. The exhibition of 1880 had representative exhibitors from twenty-four States, and was attended by 300,000 visitors. The exhibition buildings erected by the enterprise and public spirit of the trade associations, and other bodies of representative citizens, under whose auspices the exhibitions have been held for a series of years, are among the finest and best adapted for the purpose in the country. Premiums and awards are liberally offered to exhibitors in recognition of excellence.

The exhibition will be open for the reception of exhibits from Wednesday, August 17th, to Tuesday evening, September 6th, 1881. The articles exhibited must be of American manufacture, and entered by the manufacturer or his agent. No charge is made for space or power, the only fee being the nominal one of two dollars for entry. Special arrangements have been made for the cheap transportation of articles intended for exhibition. Intending exhibitors desiring further information, are requested to address J. R. Murdoch, Secretary Cincinnati Industrial Exposition, Cincinnati, Ohio.

American Industry Abroad.

The British army in South Africa, in the course of the war with the Basutos, found and destroyed some American plows. The fact is significant as showing how far-reaching is the American name and influence. The American thresher breaks the quiet and sleepy valleys of Palestine. The American mower and reaper perform the labor-saving operations among the vines and fig trees of Asia Minor. American agricultural implements carried off the prize last summer at a fair in Bulgaria, not far from where American Martini-Henry rifles, in the hands of the Turks, ranging a mile further than the old-fashioned weapons of the Russians, made deadly havoc on the fields of Plevna. American locomotives thunder over the plains of Southern Russia, and through the gorges of the Caucasus to Tiflis almost on the confines of Persia.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold their midsummer meeting at Altoona, Pa., on the 10th, 11th and 12th of August. The place is not only well chosen as a delightful spot in which to pass three days of midsummer among the mountain breezes of the Alleghenies, but will afford the visiting members an excellent opportunity for professional observation and study, as here are located the extensive and admirably organized shops of the Pennsylvania Railroad Company. A visit has also been planned to the works of the Cambria Iron and Steel Company at Johnstown.

New Publications.

A Practical Treatise on the Manufacture of Starch, Glucose, Starch Sugar and Dextrine. Based on the German of Ladislaus von Wagner, Professor in the Royal Technical High School, Buda-Pest, Hungary; and other authorities. By Julius Frankel. Edited by Robert Hutter, Practical Manufacturer of Starch Sugar, proprietor of the Philadelphia Starch Sugar Works. Illustrated by fifty-eight engravings, covering every branch of the subject, including examples of the most recent and best American machinery. Philadelphia: Henry Carey Baird & Co., Industrial Publishers, Booksellers and Importers. London: E. & F. N. Spon. 1881. Price, $3.50.

The industries with which this useful volume deals, especially the manufactures of glucose and starch sugar, have of late years attained to immense proportions, and from comparative recent beginnings. They have attracted much interest too, by reason of the mystery which surrounds the manufacture, and which the manufacturers have sought in every way to maintain and magnify. Public interest has lately been very generally drawn to these industries by certain circumstances, widely commented on by the newspapers, which brought out prominently the fact for the first time, that many millions of pounds of starch sugar and glucose were being manufactured in this country, and consumed in many industries as a cheap substitute for cane sugar and syrups, and the suspicion that they are largely used as adulterants of cane sugar products, has intensified this interest. As intimated, however, in the foregoing, the reticence of the manufacturers concerning the disposition of their products, and the secrecy with which they conduct their manufacturing operations, while they have stimulated public curiosity to learn something about these industries, have thus far succeeded in withholding most of the essential details of the operations involved. It is publicly known concerning these, however, that they have proved immensely profitable, and that they are being rapidly extended beyond their already enormous proportions.

The present work is the only one on this subject ever prepared in the English language. In its general treatment of the subject, the work follows that of one of the best European authorities, and the editor's practical familiarity with the industry is the best evidence that could be desired that the best and most recent features of American practice are faithfully described. The work bears evidence of having been prepared with great care, and is a timely and valuable addition to technical literature.

The Civil Engineer's Pocket-Book, etc. By John C. Trautwine, Civil Engineer, Philadelphia. Illustrated with 680 engravings from original designs. Fifteenth thousand. Revised and corrected. Philadelphia: E. Claxton & Co. London: Trübner & Co. 1881.

The best evidence of the esteem in which this excellent pocket-book is held by the fraternity of civil engineers, is afforded by the fact that the edition we are called on to notice, is the fifteenth, the fourteenth edition, which we noticed but a few months ago, having been rapidly exhausted. The present edition contains ten additional pages and as many additional engravings. The most important addition is the portion which treats of "Centers for Arches." Besides this section, many short but instructive additions have been made throughout the volume.

Trautwine's "Pocket-Book" was ostensibly prepared for young members of the profession, and for this reason the author has made it his leading object to elucidate the principles and facts which constitute the foundation of civil engineering in plain English, so as to make them readily comprehensible. While this partly explains the remarkable popularity of the volume, there are other and more substantial reasons to account for it, namely, the extensive and varied fund of information it contains, and its strict accuracy of statement.

Working Drawings, and How to Make and Use them. Designed for Industrial, Technical, Normal and the Higher Grade Grammar Schools; Academies and Night Schools; and Artisans desiring a knowledge of the Principles of Pattern and Template Making. By Lewis M. Haupt, Professor of Civil Engineering in the University of Pennsylvania, etc. Philadelphia: Jos. M. Stoddard & Co. 1881.

This is a very good manual of instruction in the principles of projections as applied to making and reading working drawings. The necessity for such knowledge as this work is designed to furnish, is imperative for a thorough mastery of many of the arts and industries. The insufficiency of the instruction imparted in our public schools in this branch of study, and the decay of the apprentice system by throwing artisans almost entirely upon their own resources in acquiring this important knowledge, are specially referred to as reasons for the preparation of this manual. The author's experience of years as director of the Drawing School of the Franklin Institute, qualifies him specially well to appreciate and meet the wants of students, a fact of which the present work bears testimony.

Useful Information for Steam Users, and Rules for Engineers and Firemen, for the Management and Care of Steam Boilers. New York: The J. N. Mills Publishing Co. Price, 25 cents.

This handy little pamphlet comprises about 20 pages, devoted to the subjects named in its title. The rules for engineers and firemen for the management of steam boilers, are those recommended by the Hartford Steam Boiler Inspection and Insurance Company, and may therefore be accepted without further statement as excellent and trustworthy. These are followed by a number of useful practical hints to engineers; and in conclusion, there are added a number of paragraphs relating to boiler construction and materials, various types of boilers, boiler appliances, horse-power, heating surface, fuel and the proper conditions for combustion, and other information of a general character valuable to those having charge of steam generators.

Twelfth Annual and Thirteenth Statistical Report of the Cincinnati Board of Trade and Transportation, for the Commercial Year ending January 1, 1881, and the Fiscal Year, March 1, 1881. Cincinnati, 1881.

This interesting document affords abundant evidence of the business energy and enterprise that have won for Cincinnati a leading position among American cities. The report of the directors reviewing their action during the year, shows a highly creditable degree of activity in many matters affecting the manufacturing and commercial interests of the city. The most interesting and valuable portion of the report, however, is that which gives a general review of the manufactures of Cincinnati for the past year. Further than this, the report abounds in useful statistics relating to the commerce and manufactures of the city, which will be appreciated by all who are interested in such subjects.

OTHER PUBLICATIONS RECEIVED.

Annual Catalogue of the State Agricultural College of Michigan. 1880-1.

Engineer Department of the United States Army. The Water-

Jet as an Aid to Engineering Construction. A historical sketch of its application to the sinking of piles and caissons and the removal of sand bars and other alluvial deposits; embracing a detailed account of the method employed in driving sheet-piles for pier lining at the harbors of Two Rivers, Ahnapee and Sturgeon Bay, Wis. By L. Y. Schermerhorn, C.E., under the direction of Henry M. Robert, Major of Engineers U. S. A. Washington: Government Printing Office. 1881.

Contributions to the Theory of Blasting, or Military Mining. By H. Höfer, Ordinary Professor at the Royal Imperial School of Mines at Przibram. From the Austrian "Zeitschrift für Berg-und Hüttenwesen," Vol. XXVIII., 1880. Translated by Captain Charles W. Raymond, Corps of Engineers, U. S. A., Instructor of Practical Military Engineering at West Point. Washington: Government Printing Office. 1881.

Pennsylvania—Annual report of the Secretary of Internal Affairs. Part III. Industrial statistics. 1879–1880. Harrisburg: State Printer. From the Secretary.

Department of Agriculture. North Carolina Agricultural Experiment Station. Analyses and Valuation of Commercial Fertilizers and Chemicals. Season of 1881. Raleigh: State Print. 1881. From the Director.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of THE MANUFACTURER AND BUILDER. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2850) PETRIFIED HUMAN BODIES.—I send you with this a marked copy of one of the newspapers of a neighboring city, giving a long account of the finding of a completely petrified human body in removing the bodies from an abandoned graveyard. Do you think such a thing possible, or is the story made out of whole cloth? I have often read similar accounts, but have always set them down as fabrications. Please give me your opinion.—A. J. P., M.D., Summit Hill, Pa.

(2851) INVENTION OF THE SEWING MACHINE.—I have lately read the statement that the sewing machine was the invention of an Englishman named Thomas Sainte, who made the invention as long ago as 1790. I would like your opinion as to whether any one else than Howe is entitled to the credit of this great invention.—J. C. McC., Berwick, Me.

(2852) COAL AND IRON PRODUCTION.—I declared in a discussion lately, that more coal and iron were mined and manufactured in the United States than in any European country. One of the parties present, however, declared that I was wrong, and that the production of Great Britain, of both coal and iron, was far ahead of that of the United States. As neither of us has access to any authorities to prove our case, it was decided to refer the question to you for decision, with the request that you reply through your valuable department of "Notes and Queries." By so doing in your forthcoming issue, you will oblige several constant readers.—E. H. J., Moorestown, N. J.

(2853) DEPHOSPHORIZING IRON ORES.—Is there any reliable process for removing phosphorus from iron ores before reduction? I am aware of the existence of immense beds of such ores, which I am told are practically valueless on account of this substance.—J. M. McA., Ashland, N. C.

(2854) REPEATING FIRE-ARMS.—Who first invented repeating fire-arms?—J. C. McC., Berwick, Me.

(2855) PAVEMENTS.—What pavement for city streets is considered to be the best?—F. F., York, Pa.

(2856) ABSORBENT COTTON.—I wish to know how I can make the absorbent cotton, much used by dentists. If you can assist me with a formula for preparing it, you will greatly oblige a constant reader.—C. D. A., Albany, N. Y.

(2857) CASTING A LOOSE BODY WITHIN ANOTHER.—In perfecting an invention I am at work on, I think it would be advantageous to cast a piece with a free body, like a sphere, in a hollow shell of cylindrical or spherical form. Can it be done? —J. H., Newville, Pa.

(2858) DYNAMITE AND NITRO-GLYCERINE.—What is the difference between dynamite and nitro-glycerine? Which of the two is the more powerful explosive?—B. H., Atlanta, Ga.

(2859) ENERGY OF VARIOUS EXPLOSIVES.—If it will not take too much of your space after answering the questions about dynamite and nitro-glycerine, please give me a list of the more important explosive compounds and mixtures, with their relative values as explosives.—B. H., Atlanta, Ga.

(2860) WHITE AND GREEN RUBBER.—Can you inform me how I can make white and green rubber, for painting on coarse cloth, that will not crack, and be water-proof, the same as table-cloth.—A. B., Jersey City, N. J.

(2861) SALT PRODUCTION.—Please state in your answers to correspondents if the United States produce all the salt they require; or if not, what percentage is imported.—S. L., Louisville, Ky.

REPLIES.

(2850) PETRIFIED HUMAN BODIES.—Such a thing as a veritable human petrifaction—that is, the conversion of the soft parts of a human body into a substance of a stony nature, may be safely asserted to be impossible by any natural process; and all accounts asserting bodies to have been found preserved, after long interment, in such a manner as to warrant the use of the word "petrified" in describing them, may be set down either as deliberate fabrications or gross exaggerations. In every pretended case of this kind that has been brought to the attention of men of science—and many thousands have been investigated—the bodies have been found to be converted into a peculiar fatty substance known to science as *adipocere* (from *adeps*, fat; and *cera*, wax), a substance which neither in character, appearance nor qualities would suggest or warrant its designation as stony matter. The fact that under certain favoring circumstances the soft parts of the human body would be converted into adipocere, a peculiar fat, was first observed and brought to the attention of the learned world by a French chemist, Fourcroy, in 1787. About that time, when the great cemetery of the Innocents in Paris was removed, great masses of this substance were found, where the coffins containing the dead bodies had been placed close together, at the bottom of the coffins. In these cases there was found a shapeless mass of a dingy white color, flattened as though it had been subjected to great pressure. The whole body had been converted into this fatty matter, except the bones, which remained, but were extremely brittle. Chemical examination revealed the fact that it was composed principally of margarate of ammonia, and that it was therefore a true fat. The conditions under which dead bodies pass into this substance, instead of falling into decay by gradual putrefaction, have been tolerably well ascertained. It is known, for example, that the favoring conditions are long immersion in running water or burial in moist situations. It is no doubt this peculiar conversion of human bodies that has given rise to the many accounts of the finding of "petrified" bodies, where there was any truth at all in the story. But this change of the soft parts of the body into fat is in no sense a petrifaction. Pretended petrifactions, like the well-known Cardiff Giant, have been exhibited throughout the country, but no one of any intelligence could be duped into the belief that they were really what they were pretended to be. All such alleged petrifactions, are simply clever frauds chiseled out of stone. We may state in addition, in explanation of many accounts of human "petrifactions," that the most astonishingly false and exaggerated statements respecting such cases, are often given out and vouched for by parties whose love of the marvelous, it is charitable to suppose, gets the better of their judgment. In proof of this, we have the evidence of Dr. A. A. Cutting, of Vermont, a scientific man of note, who personally examined several cases of this kind, in which persons who, in ordinary matters, were reliable witnesses enough were ready to make oath to the fact of a perfect petrifaction. In these cases the bodies were simply remarkably well preserved by the adipocere process above described. In referring to one of these cases, Dr. Cutting wrote: "If . . . petrified, that petrifaction would bring more than its weight in gold, and it would require a body-guard, even in the quiet town of St. Johnsbury, to keep it buried. Such a specimen placed in the British Museum, would be valued higher than the crown jewels, and would be a relic more rare than anything that exists on earth." Thus far, we may add in conclusion, all the investigations of alleged "petrifaction" of human or other animal remains by scientific men, have failed to find a single case of veritable petrifaction, or anything like it; and when one considers the rapidity with which the soft parts of all animals putrefy and disappear, the impossibility of their "petrifaction" by any natural process should be evident.

(2851) INVENTION OF THE SEWING MACHINE.—If the honor of an invention belongs to the man who devised and constructed a machine that worked practically and successfully, and that was the starting point for every subsequent invention that made the machine what it is now, then unquestionably the honor of having invented the sewing machine belongs to Elias Howe. The justice of this decision, we think, no one will seriously dispute. The idea of constructing a sewing machine, however, did not originate with an American, but was originally the thought of an Englishman with the very German name of Weisenthal, who, as early as 1755, obtained a patent for a crude device for facilitating the process of embroidery. Weisenthal's invention involved the use of a double-pointed needle, with an eye in the middle, to go backward and forward through the cloth. So far as can be learned, Weisenthal's machine could not be made to work—at least there are no evidences that it was ever utilized. Weisenthal was followed, in 1790, by the Thomas Sainte referred to by our correspondent, who in that year obtained a patent for a machine "for quilting, stitching and sewing, making shoes and other articles by means of tools and machines." Sainte employed a vertical reciprocating needle, and an awl to go before it and punch the holes. His stitch was called the chain-stitch. A loop was formed by thrusting the needle through the cloth or leather, a second thrust carried the bight of thread through this loop, making a second loop, through which in turn the needle was thrust to form a third, the first loop being drawn up taut during the third thrust. This variety of stitch is in use to-day. Sainte's idea seems to have been to lighten the labor of heavy sewing; he does not appear to have thought of the plan of superseding the hand-needle for general and domestic work. Following Sainte, came John Duncan, in 1804, with an improvement on the method of making the stitch; and in 1807, James Winter with an invention for sewing leather gloves. These were followed by a contrivance for sewing with needlefuls of thread, the cloth being crimped for the operation, and the needles thrust through the crimps horizontally. All these devices met with little attention, and were abandoned and forgotten. What might have become of them had the time been more propitious for the introduction of labor-saving machinery, can only be left to the imagination. Some years after the last named date, the first American sewing machine was invented by the Rev. John Adams Dodge, of Monkton, Vt. This was said to have really been a practical and efficient machine for sewing the back-stitch. He used a double-pointed needle, with the eye in the middle, and going entirely through the cloth in both directions. It sewed a perfect seam straight forward, but the feeding mechanism was of such a nature that it would not permit of the cloth being turned. This machine is well spoken of by those who have interested themselves in studying the development of the sewing machine. Its inventor, however, burdened by professional duties and troubled by the bitter opposition it encountered from the journeymen tailors, abandoned the invention without further efforts to perfect it. It was never patented. Dodge was followed, in 1832, by Walter Hunt, a skillful mechanic, who devised a working machine, and sold a number of them. He was the first to use two threads; the upper one was carried by a curved needle with the eye in the point, and the lower one by a shuttle. His stitch was the lock-stitch. He did not, unfortunately for himself, patent his invention at the time, and when, in 1852, he applied to the Patent Office, he was informed that his neglect had made his invention public property. Passing by several inventions of minor importance, we come now to Howe, through whose inventive faculty and remarkable perseverance in the face of repeated failures, the sewing machine was made a successful, practical machine. In 1846, he secured a patent for a machine, which, while it covered much of the ground that his predecessors had gone over, was nevertheless regarded by the Patent Office as so novel in its combination of parts, as to be entitled to be considered a new invention. He used a curved, eye-pointed needle; a shuttle below the cloth, driven by two vibrating mallets; a peculiar baster-plate to hold the cloth and feed it forward, the plate being pushed back when it had reached the limit of its forward travel, the cloth again fastened to points upon it, and the plate again fed forward; and a device to give tension to the upper thread. This machine was far from being satisfactory, but was nevertheless so much in advance of all preceding attempts, that it is properly regarded as the prototype of the sewing machine of to-day. Many important improvements in details were made upon this machine, each of which added materially to the ease and certainty of its action, and contributed to make the sewing machine the perfect apparatus it is to-day. But Howe's original machine, and the remarkable pertinacity with which he persisted in his efforts to introduce it to public favor, are really the things which gave the first real impulse to the development of the sewing machine. The few years following the bringing out of Howe's machine were very prolific in sewing machine inventions, and while many of these were highly important and their originators deserving of the highest praise, it does not alter the fact that they all had their starting point with the machine first invented by Howe. The subject of this query is of so much general interest, that we have been tempted into treating it at greater length than is usual in this department.

(2852) COAL AND IRON PRODUCTION.—Our correspondent E. H. J. is wrong in making the assertion that the production of coal and iron in the United States (we presume he means the annual production) exceeds that of any European country; and his opponent is right in his declaration that the production of Great Britain exceeds that of this country. We give, in proof of this, a few statistical tables from official sources, which will give the leading facts our correspondent asks for. The figures of production relate to the years 1869 and 1880. The figures will hold good for the present time, as the relative positions of the countries named will not be substantially affected by the progress of the past year.

WORLD'S PRODUCTION OF PIG AND CAST IRON.

	1869.	***1880.***	*Increase.*
Countries.	*Tons.*	*Tons.*	*Tons.*
Great Britain	5,445,757	7,721,833	2,276,076
United States	1,916,641	4,295,415	2,378,773
Germany	1,180,579	1,950,000	769,412
France	1,018,899	1,733,102	714,203
Belgium	534,319	610,000	75,681
Totals	10,096,195	16,310,350	6,214,145

The world's output of coal was as follows:

	1869.	***1880.***	*Increase in* 1880.
Countries.	*Tons.*	*Tons.*	*Tons.*
Great Britain	106,506,683	147,000,000	39.493,317
United States	28,100,000	63,500,000	35,400,000
Germany	26,744,000	42,161,000	15,387,000
France	13,509,000	18,857,000	5,348,000
Belgium	12,943,000	14,000,000	1,057,000
Austria	4,100,000	6,000,000	1,900,000
Russia	588,000	2,200,000	1,612,000
Spain	550,000	730,000	200,000
Totals	193,040,683	294,468,000	100,397,317

By consulting these tables, it will be seen that Great Britain stands considerably in advance of this country in the manufacture of iron, and vastly exceeds it in the output of coal. In the latter industry Great Britain produces about as much as the rest of the world combined.

(2853) DEPHOSPHORIZING IRON ORES.—Several processes for removing phosphorus from iron ores have been proposed from time to time, but only one of these has been systematically operated with something like practical success. The process in question is that of Herr Jacobi, which is, or was, in operation at the Adelbert Iron Works at Kladno, Bohemia. The operation is described as follows: The ores are first roasted in small kilns, after which they are placed in tanks capable of containing several thousand tons of ore, in which they are submitted for some time to the action of water containing sulphurous acid in solution. The acid in question is generated from the roasting of iron pyrites and condensing the acid fumes with water in coke towers. The effect of the action of the acid on the iron ore, is that the greater portion of the phosphorus is dissolved and enters into solution as phosphate of lime, alumina, etc., which, when drawn off, leaves the ore in a state of comparative purity; that is, almost free from sulphur, which is likewise removed by the calcination and subsequent working, and with only 0.28 to 0.4 per cent of phosphoric acid, so that the iron subsequently made therefrom is found well adapted for making rails and the like, for which it was previously entirely unfitted. Herr Jacobi has carried his process still further, and even utilizes the phosphorus removed from the ores. Taking advantage of the fact that the phosphorus dissolved in the acid solution will be precipitated by simply boiling to drive off the volatile sulphurous acid, the solution, when drawn off from the iron ore, is passed through a coil of iron pipes heated in a furnace, and is allowed, while boiling, to run into settling tanks, in which the phosphate deposits itself, and from which, after drawing off the superfluous water, it is removed and dried, in which state it is sold as a fertilizer. The composition of this material is chiefly phosphate of lime and alumina, with but a trifling percentage of iron. The sulphurous acid driven off during the boiling process, is reconducted into the condensing towers, and is thus made to do service again and again to leach out the phosphorus from fresh supplies of ores. Herr Jacobi affirms that the sale of the phosphate covers the whole cost of the purifying process. The process has been successfully used for a number of years at Kladno, and is probably in use there and elsewhere at present. It could probably be profitably introduced elsewhere with equally favorable results. We do not know, however, that this or any similar process is in use in this country. The recent development of the process of dephosphorization in the Bessemer converter, by the process of Messrs. Thomas & Gilchrist, has made the question of phosphorus in iron ores, intended for steel production, of far less importance than it formerly was, and especially since the use of Bessemer steel has of late years vastly extended, and by reason of its growing cheapness bids fair to come even more generally into use as a substitute for iron in the near future. The Thomas-Gilchrist process will be found described in almost any of the technical journals of about a year ago.

(2854) REPEATING FIRE-ARMS.—The repeating fire-arm is a purely American invention, and the first important use of arms of this type was by the troops of the United States during the Mexican war. The idea originated with Samuel Colt, an American seaman, who, while on a voyage to Calcutta in 1829, devised a six-barrelled revolver to be used with percussion caps. He improved upon this in 1835, by bringing out a fire-arm having a six-barreled rotary breech, the bullets all making their exit therefrom through a single long barrel, as in the modern revolver. Colt secured patents for his invention in England, France and the United States, and for a short time carried on the manufacture of revolvers in Paterson, N. J. A number of Colt's revolving carbines were used in 1837 in Col. Harney's campaign against the Indians, and about a thousand of them were used by our troops in the Mexican war. The discovery of gold in California shortly after this time, caused an immense demand for Colt's revolvers, and their manufacture was enormously increased. The exhibition of these weapons at the World's Fair in London in 1857, created a decided sensation, and secured for them an extensive sale in Europe. They were largely used in the Crimea, and by Garibaldi in his Italian campaigns, and speedily found their way into all the European armies. Colt had the mechanical foresight to use the interchangeable system in his manufacture, and this fact, together with the general excellence of his weapons, gave them an enormous popularity. Colt's success brought others into the field, and the Derringer, Smith & Wesson, and other now well-known weapons were brought out. Repeating rifles of the breech-loading type originated with the Spencer rifle. This weapon loads at the breech, and holds a magazine of seven cartridges in the stock, which are thrown forward one at a time by a coiled spring when the breech is opened to receive a new charge. Many modifications and improvements of this type of fire-arm have since been made. The application of the repeating principle to field arms likewise originated in this country, the first arm of this kind being the Gatling battery, an automatic machine gun with six steel barrels, into which cartridges are fed from a hopper, and discharged by turning a crank.

(2855) PAVEMENTS.—There is much difference of opinion among engineers on this important question, the choice lying between pavements of granite blocks, wood and asphaltum. The requirements of a pavement are very various, and each of the above named materials excels in certain particulars, and is inferior in others. On the whole, the best engineering opinion inclines to favor asphaltum as possessing the largest number of good qualities. The experience in this country with asphaltum pavements and sidewalks has not been uniformly good. This fact is to be explained entirely on the ground of inferior construction, coal tar and other inferior mixtures being largely used in place of the rock-asphalt, or Trinidad asphaltum, which should be used. In European cities, especially in those of England, France and Germany, the admirable qualities of the asphaltum roads and footways at once attract the attention of American tourists; and they have withstood the severest tests of climate and durability successfully. The true asphaltum pavement is free from noise; it compacts under pressure, and hence suffers very little from abrasion or wear; it is absolutely impervious to moisture and gases, hence it absorbs no unwholesome liquids, gives out no offensive gases, and is easily cleaned of its surface defilement. In respect to durability, it has an admirable record. Neither heat, cold, hammering nor attrition affect it; and the facility with which it can be repaired is unequalled. It presents a smooth, hard, continuous, tough and elastic surface, affording a secure foothold for horses (except on steep gradients or when covered with ice), and a minimum resistance to draught. As regards wooden pavements, American experience has been even more unfortunate than with the (so-called) asphaltum. The wood pavement affords a secure foothold for horses, is practically noiseless and affords a smooth, easy roadway for vehicles. The material is, however, a rapid absorbent of moisture, speedily decays, and, beneath the hammering of horses' hoofs, develops innumerable hollows and ruts that make it unendurable. The average life of a wooden pavement in this country will not exceed five years, and it is very troublesome to tear up and repair. The granite block of narrow rectangular shape, laid on edge, the longest edge set across the street, makes, when properly laid, the most durable of all pavements. It affords a good foothold for horses, it can readily be taken up and re-laid when necessary, and is readily cleaned. The only serious objection to this pavement is the deafening din and clatter it gives out from the passage of horses and vehicles. The granite block pavement is harder on vehicles than either asphaltum or wood; it is a collector of dirt and filth, though to a less extent than wood. In freezing weather it is superior to either wood or asphaltum. From the above comments, it will be observed that no one pavement excels in all the requisites of a good pavement, and in judging of their relative merits, we must take all the desirable or important requirements and give the palm of superiority to that one which excels in most of them. Adopting this plan, we find the relative merits of asphaltum, wood and granite pavements, with respect to the more important requirements, to be as follows, the three varieties being designated by numbers in the order of their relative excellence—the best by 1, the next by 2, and the poorest by 3:

Qualifications.	*Asphaltum.*	*Granite.*	*Wood.*
Ease of traction	1	3	2
Minimum destruction of vehicles	1	3	2
Comfort to rider	1	3	2
Foothold to horses—dry	3	2	1
" " —wet	1	2	3
Freedom from noise	1	3	2
" " dust	1	3	2
" " mud	1	3	2
" " exhalations	1	2	3
Facility of cleaning	1	2	3
Durability	2	1	3
Accessibility to pipes and re-laying	2	1	3

From the foregoing tabulation, it will be perceived that out of 12 items, which include all the important requirements of a good pavement, asphaltum excels both its rivals in 9; is excelled by granite in 3; and by wood in 1. Granite excels both its rivals in 2 items out of the 12, and excels wood in 6; while wood excels both of its rivals in only 1 item of the 12; excelling granite in 7. Summarizing the results, we must conclude that asphaltum, *all things considered*, is much the best pavement; granite blocks would be entitled to the second place, and wood to the third. We repeat in conclusion, what we stated at the outset, that we speak here of the genuine asphaltum pavements as represented by the best examples in use in European cities, and not to the sticky abominations fitly designated as "poultice" pavements, which often pass under the name of asphaltum in American cities.

(2856) ABSORBENT COTTON.—The so-called absorbent cotton in general use among dentists, is cotton wool which has been thoroughly freed from the oily and greasy matter which it naturally contains, and which by its presence prevents the rapid wetting of the cotton fibers. To prepare cotton to become eminently absorptive, we recommend to this correspondent the following process proposed by Mr. Frank L. Slocum, after many experiments to determine the best method of its preparation, viz.: Take the best quality of carded cotton batting, any desired quantity, and boil it with a 5 per cent solution of caustic potassa, or soda, for half an hour, or until the cotton is entirely saturated with the solution and the alkali has saponified all oily matter. Then wash thoroughly, to remove all soap and nearly all alkali; press out the excess of water, and immerse in a 5 per cent solution of chlorinated lime for 15 or 20 minutes; again wash, first with a little water, then dip in water acidulated with hydrochloric acid, and thoroughly wash with water; press out the excess of water, and again boil for 15 or 20 minutes in a 5 per cent solution of caustic potassa or soda; now wash well, dipping in the acidulated water, and washing thoroughly with pure water. Afterwards press out and dry quickly. Boiling with caustic alkalies saponifies all oil and greasy matter, and the soap formed is removed by washing; if it were not washed out before bleaching, an insoluble lime soap would be formed and precipitated on the fibers. Dipping in very dilute hydrochloric acid after bleaching, renders the removal of calcium compounds more easy. At this stage the cotton has all the appearance of absorbent cotton, but it absorbs water rather slowly; when again boiled with a caustic alkali, more organic matter of a non-greasy nature is removed, and the cotton is rendered perfectly absorbent. On dipping the cotton in dilute hydrochloric acid at the last washing, a chloride is produced with the caustic base used, which is more readily washed out than the alkali itself. The amount of loss by this process is practically 10 per cent. A sample of 360 grains lost, on boiling with alkali and bleaching, 15 grains, or 4.17 per cent, and 270 grains of this bleached sample lost, on again boiling with an alkali, 14 grains, or 5.18 per cent—a total loss of 9.35 per cent. Microscopical examination shows that cotton fibers are tubes, and the presence of oily matter in the fiber prevents the wetting of the cotton in water by stopping capillary attraction in the tubes. By freeing the cotton fiber of oil, the obstruction to capillary attraction is removed, and the cotton fibers will instantly absorb water.

(2857) CASTING A LOOSE BODY WITHIN ANOTHER.—There is no difficulty in casting a loose body within a metallic shell, if we understand our inquirer's question aright, and any expert founder can do it without trouble. Ball valves, swivel joints, sleigh bells, and many other articles, afford cases in point where a shell is cast about a ball or other body, that is left free to move afterwards. We judge that the same artifice adopted in making these articles would be found to answer in the case propounded here. Sleigh bells, for example, are made as follows: The iron ball is put inside of a sand core just the size of the inside of the bell. A mold is then prepared for the outside of the ball, the sand core, with the ball enclosed, is placed in proper position within the mold of the outside, and the molten metal poured in when all is ready. The metal fills up the space between the core and the mold. When cooled, the sand of the core can easily be shaken out, leaving the ball free to move within the shell.

(2858) DYNAMITE AND NITRO-GLYCERINE.—Dynamite is the name given to an explosive powder made by saturating some light, finely pulverulent earthy substance with nitro-glycerine. Nitro-glycerine is the oily explosive itself. The idea of using some inert powder as a carrier for nitro-glycerine, originated with the Swedish engineer Nobel, and his mixture soon became very popular, and is the type of a great number of nitro-glycerine powders. Nobel uses a very fine, mealy infusorial earth as the absorbent of the explosive. It must be obvious from the above explanation, that of the two explosives, the pure nitro-glycerine must be the more powerful, as the addition to it of an inert powder must proportionally reduce its explosive power, just as would the addition, say of sand, to gunpowder. Pure nitro-glycerine is the most powerful explosive known.

(2859) ENERGY OF VARIOUS EXPLOSIVES.—We add, for the information of this inquirer, the following tabulation, giving the comparative qualities of a number of explosives. The figures are given on the authority of M. Berthelot, a well-known chemical authority. The first column indicates the heat furnished by 1 kilogramme (2.2 pounds) of the explosive; the second column, the volume of gases disengaged in the explosion; and the third, the resulting product of these two qualities, serving as an approximate estimate of the comparative explosive force of each of the substances:

Explosive.	*Heat.*	*Volume of Gases.*	*Estimated Explosive Force.*
Blasting powder	500	0.173 liters.	88
Artillery "	608	0.225 "	137
Sporting "	641	0.216 "	139
Powder; nitrate of soda for its base.	764	0.248 "	190
" chorate of potassa "	972	0.318 "	309
Gun-cotton	590	0.801 "	472
Picric acid	687	0.780 "	536
Picrate of potassa	578	0.585 "	337
Gun-cotton mixed with chlo. potassa	1420	0.484 "	680
Picric acid " "	1424	0.408 "	582
Picrate " "	1432	0.337 "	478
NITRO-GLYCERINE	***1320***	***0.710*** "	***930***

(2860) WHITE AND GREEN RUBBER.—A rubber varnish, which is said to produce very satisfactory results on cloth, is prepared as follows: Soften ¼ pound crude India rubber, cut into small pieces, in ½ pound oil of turpentine; then add 2 pounds of boiled linseed oil, and boil for two hours over a slow fire. When the mixture has completely dissolved, add 6 pounds of boiled linseed oil and 1 pound of litharge, and boil until a smooth liquid is obtained. Any pigment, black or green, may be incorporated with the varnish when finished. The varnish should be applied warm.

(2861) SALT PRODUCTION.—From the latest records accessible, we may inform this correspondent that the annual product of salt in the United States at the present time, is approximately 20,000,000 bushels, of which Michigan produces about 6,000,000; New York and West Virginia, each about 4,500,000; Ohio, nearly 3,000,000; and the other States together, something over 2,000,000. The annual consumption of salt in the United States is about 40,000,000 bushels. Our correspondent will see, therefore, that we produce only about one-half of the amount actually required for home uses.

THE MANUFACTURER AND BUILDER.

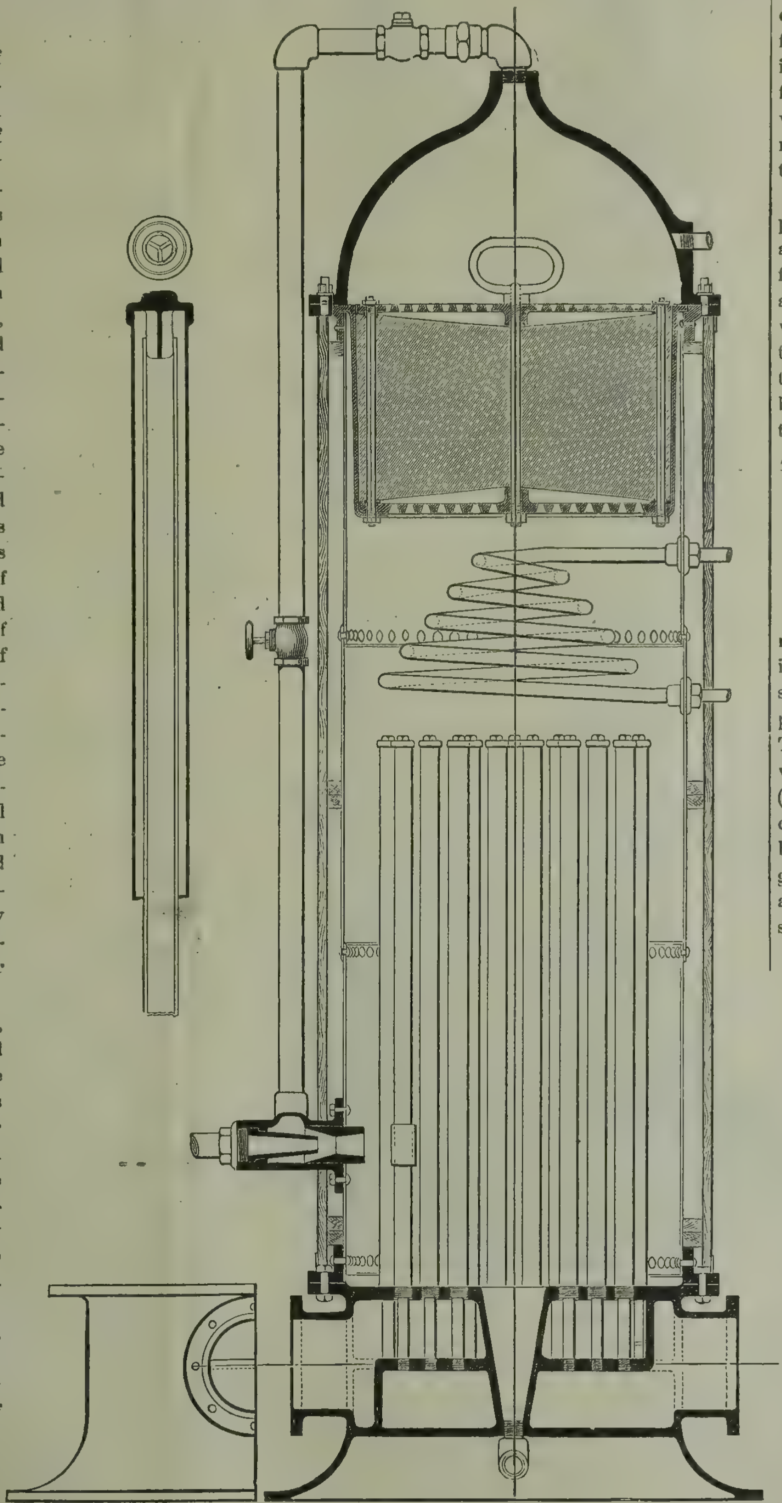
Vol. XIII.—No. 9. SEPTEMBER, 1881. THIRTEENTH YEAR.

Strong's Improved Feed-Water Heater and Purifier.

In order to properly understand the requirements of an effective feed-water purifier, it will be necessary to understand something of the character of the impurities of natural waters used for feeding boilers, and of the manner in which they become troublesome in causing incrustation or scale, as it is commonly called, in steam boilers. All natural waters are known to contain more or less mineral matter, partly held in solution and partly in mechanical suspension. These mineral impurities are derived by contact of the waters with the earth's surface, and by percolation through its soil and rocks. The substances taken up in solution by this process, consist chiefly of the carbonates of lime and magnesia, the sulphate of lime, and the chloride of sodium. The materials carried in mechanical suspension are clay, sand and vegetable matter. There are many other saline ingredients in various natural waters, but they exist in such minute quantities, and are generally so very soluble, that their presence may safely be ignored in treating of the utility of boiler waters.

Of the above named salts, the carbonates of lime and magnesia are only soluble when the water contains free carbonic acid. Our American rivers contain from 2 to 6 grains of saline matter to the gallon in solution, and a varying quantity—generally exceeding 10 grains to the gallon—in mechanical suspension. The waters of wells and springs hold a smaller quantity in suspension, but generally carry a larger percentage of dissolved salts in solution, varying from 10 to 650 grains to the gallon.

When waters containing the carbonates of lime and magnesia in solution are boiled, the carbonic acid is driven off, and the salts, deprived of their solvent, are rapidly precipitated in fine crystalline particles, which adhere tenaciously to whatever surface they fall upon. With respect to the sulphate of lime, the case is different. It is at best only sparingly soluble in water, one part (by weight) of the salt requiring nearly 500 parts of water to dissolve it. As the water evaporates, however, in the boiler, a point is soon reached where supersaturation occurs, as the water freshly fed into it constantly brings fresh accessions of the salt; and when this point is reached, the sulphate of lime is precipitated in the same form and with the same tenaciously adherent quality as the carbonates. There is, however, a peculiar property possessed by this salt which facilitates its precipitation—namely, that its solubility in water diminishes as the temperature rises. This fact is of special interest, since, if properly taken advantage of, it is possible to effect its almost complete removal from the feed-water of boilers as readily as that of the carbonates.



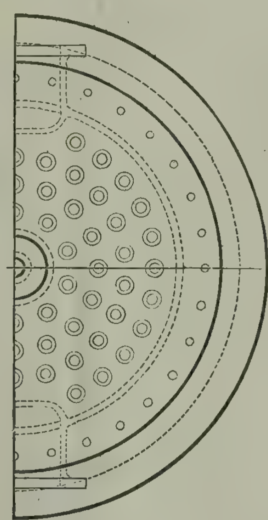


Fig. 1.—STRONG'S FEED-WATER HEATER AND PURIFIER—SECTIONAL VIEW.

There is little difference in the solubility of the sulphate of lime until the temperature has risen somewhat above 212° Fah., when it rapidly diminishes, and finally, at nearly 300°, it is completely insoluble; and all of this salt held in solution at lower temperatures, would be precipitated when the temperature had risen to that point. The following table, given on the authority of a French investigator, represents the solubility of sulphate of lime in water at different temperatures:

Temperature Fah.	*Percentage Sulph. Lime held in Solution.*	*Temperature Fah.*	*Percentage Sulph. Lime held in Solution.*
217°	0.500	245°	0.226
219°	0.477	250°	0.183
221°	0.432	255°	0.140
227°	0.395	261°	0.097
232°	0.355	266°	0.060
236°	0.310	271°	0.023
240°	0.267	290°	0.000

From this table, it will be evident that it is simply necessary to heat water up to a temperature of 250° in order to effect the precipitation of four-fifths of the sulphate of lime it may have contained, or to the temperature of 290° in order to precipitate it entirely. The bearing of these facts on the purification of feed-waters will appear further on. Chloride of sodium (common salt), and all the other more soluble salts contained in natural waters, are likewise precipitated by the process of supersaturation, but owing to their greater solubility, much more evaporation is required; all mechanically suspended matter tends naturally to subside.

Where water containing such mineral and suspended matter is fed to a steam boiler, there results a combined deposit, of which the carbonate of lime usually forms the greater part, and which remains more or less firmly adherent to the inner surfaces of the boiler, undisturbed by the force of the boiling currents. Gradually accumulating, it becomes harder and thicker, and if permitted to accumulate, may at length attain such thickness as to prevent the proper heating of the water by any fire that may be maintained in the furnace. Dr. Joseph G. Rogers, who has made boiler waters and incrustations a subject of careful study, declares that the high heats necessary to heat water through thick scale, will sometimes ac-

tually convert the scale into a species of glass, by combining the sand mechanically separated with the alkaline salts. The same authority has carefully estimated the non-conducting properties of such boiler incrustations. On this point, he remarks that the evil effects of the scale are due to the fact that it is relatively a non-conductor of heat. As compared with iron, its conducting power is as 1 to 37½, consequently more fuel is required to heat water in an incrusted boiler than in the same boiler if clean. Rogers estimates that a scale one-16th of an inch thick will require the extra expenditure of 15 per cent more fuel, and this ratio increases as the scale grows thicker. Thus, when it is ¼ of an inch thick, 60 per cent more fuel is needed; ½ inch, 112 per cent more fuel, and so on.

Rogers very forcibly shows the evil consequences to the boiler from the excessive heating required to raise steam in a badly incrusted boiler, by the following illustration: To raise steam to a pressure of 90 pounds, the water must be heated to about 320° Fah. In a clean boiler of ½-inch iron, this may be done by heating the external surface of the shell to about 325° Fah. If now ½ an inch of scale intervenes between the boiler shell and the water, such is its quality of resisting the passage of heat that it will be necessary to heat the fire surface to about 700° —almost to a low red heat—to effect the same result. Now, the higher the temperature at which iron is kept, the more rapidly it oxidizes; and at any heat above 600°, it very soon becomes granular and brittle, and is liable to bulge, crack or otherwise give way to the internal pressure. This condition predisposes the boiler to explosion and makes expensive repairs necessary. The presence of such scale, also, renders more difficult the raising, maintaining and lowering of steam.

The nature of incrustation and the evils resulting therefrom having been stated, it now remains to consider the methods that have been devised to overcome them. These methods naturally resolve themselves into two kinds—chemical and mechanical. The chemical method has two modifications; in one the design is to purify the water in large tanks or reservoirs, by the addition of certain substances which shall precipitate all the scale-forming ingredients before the water is fed into the boiler; in the other the chemical agent is fed into the boiler from time to time, and the object is to effect the precipitation of the saline matter in such a manner that it will not form solid masses of adherent scale. Where chemical methods of purification are resorted to, the latter plan is generally followed as being the least troublesome. Of the many substances used for this purpose, however, only a few are measurably successful; the majority of them are unsatisfactory or objectionable.

The mechanical methods are also very various. Picking, scraping, cleaning, etc., are very generally resorted to; but the scale is so tenacious that this only partially succeeds, and as it necessitates stoppage of work, it is wasteful. In addition to this plan, a great variety of mechanical contrivances for heating and purifying the feed-water, by separating and intercepting the saline matter on its passage through the apparatus, have been devised. Many of these devices are of great utility, and have come into very general use. In the Western States especially, where the water in most localities is heavily charged with lime, these mechanical purifiers have become quite indispensable wherever steam users are alive to the necessity of generating steam with economy.

Most of these appliances, however, only partly fulfill their intended purpose. They consist essentially of a chamber through which the feed-water is passed, and in which it is heated almost to the boiling point by exhaust steam from the engine. According to the temperature to which the water is heated in this chamber, and the length of time required for its passage through the chamber, the carbonates are more or less completely precipitated, as likewise the matter held in mechanical suspension. The precipitated matter subsides on shelves or elsewhere in the chamber, from which it is removed from time to time. The sulphate of lime, however, and the other soluble salts, and in some cases also a portion of the carbonates that were not precipitated during the brief time of passage through the heater, are passed on into the boiler.

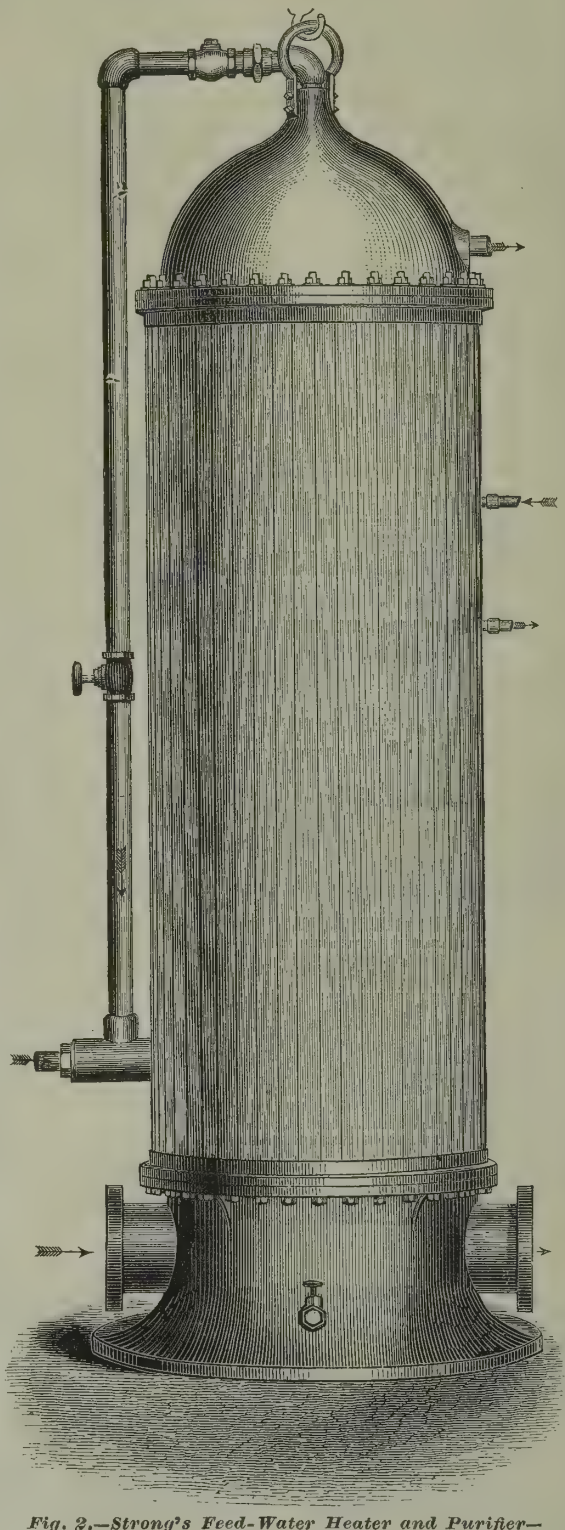


Fig. 2.—Strong's Feed-Water Heater and Purifier—Exterior View.

Appreciating this insufficiency of existing feed-water purifiers to effectually remove these dangerous saline impurities, Mr. George S. Strong, of Philadelphia, devised an improvement upon this class of apparatus, which is illustrated in the accompanying engravings in sectional and exterior views. He recognized the fact that the chief defect in existing feed-water purifiers resided in the fact that they made no provision for heating the water high enough to insure the complete separation of all the dangerous scale-forming elements. With exhaust steam, which they all employ, it is possible to raise the temperature of the feed-water on its passage through the chamber, to the neighborhood of 212°; but, as has been mentioned in the preceding portion of this article, the sulphate of lime is not separated in considerable quantity until a temperature of nearly 250° is reached. Proceeding from this fact, Mr. Strong devised a feed-water heater in which the water can be raised to that temperature before it is admitted to the boiler. In Mr. Strong's plan the feed-water is first heated to nearly 212° by exhaust steam, as is usually practiced, and as it passes through the chamber is heated to 250°, or higher, by the use of a coil of live steam from the boiler. As the feed-water in any case would have to be heated up to the temperature of the water in the boiler, the use of the coil does not involve any loss of heat except the small amount due to radiation.

By adopting this method, therefore, the mechanical precipitation which would otherwise take place partially in the boiler, occurs completely in the heater; and it is only necessary now to provide a filter which will intercept the passage of any of the separated solid matter into the boiler.

Having explained the principle of its action, we invite attention now to the apparatus itself, which is shown in section in Fig. 1, and in exterior view in Fig. 2. It consists substantially of a cast-iron base, on which is supported an upright cylindrical shell of wrought iron, surmounted by a cast-iron dome, the whole forming a closed cylindrical chamber, provided with the following parts and attachments for performing its functions as a feed-water heater and purifier. The cast-iron base is divided into two parts by a diaphragm, as seen in Fig. 1. The exhaust steam enters at the left-hand orifice (shown by direction of the arrow in Fig. 2), passes up the set of tubes which are fastened into the upper shell of the casting, returns by another set of tubes which are within the others, the lower ends of which are fastened into the diaphragm, and passes away by the passage seen on the right (and indicated by the direction of the arrow in Fig. 2). An enlarged section of the upper part of the tubes is shown on the left-hand side of Fig. 1, from which the course of the exhaust steam will be understood. The inner tube only serves for discharge. This arrangement, while securing a large heating surface in a small space, at the same time leaves great freedom for expansion and contraction. The free area for passage of steam is arranged so as to be one and a half times that of the exhaust pipe, so that all danger of back pressure is avoided. The wrought-iron shell connecting the base with the dome is made strong enough to withstand the full boiler pressure. It is jacketed with a wooden or other casing to prevent loss of heat by radiation. The cold feed-water is admitted into the lower portion of the heater through the injector, seen on the left (Fig. 1), and, coming in contact with the tubes, is heated; it then rises to the coil seen above the tubes, and which is supplied with live steam from the boiler. Here the water is still further heated, acquiring a temperature of 250° to 270° Fah., according to the pressure in the boiler. This high temperature causes a very complete separation of the saline impurities of the feed-water. Rising still further, the water passes through a filter composed of wood charcoal in its lower half and bone-black above, firmly held between perforated plates. This frees it from all suspended and precipitated matter, and it enters the dome, from which it passes to the boiler through the pipe seen on the right-hand side (shown by the arrow in Fig. 2). The pipe passing from the top of the dome to the injector is intended to cause a continual passage of steam from the upper part of the dome to the lower part of the heater, so that any precipitate carried up in froth may be again returned to the under side of the filter. After being in use for from 3 to 10 hours, according to the amount of the impurities the water carries, it is necessary to blow out the heater in order to clear the filter from the deposit. To do this, live steam is admitted through the boiler

connection in the dome. This discharges the water in the opposite direction and cleans out the filter, the water and sediment being blown out at the bottom. To clean the filter out completely, the steam should be allowed to pass through the filter for some little time. After this operation, the apparatus is ready to be put in use again. The same filter will do service for months if properly cared for in the manner described. The filter can readily be removed, by first removing the dome, when it requires to be renewed.

These feed-water heaters have done excellent service wherever they have been put in use, and have been very favorably received by engineers and steam users throughout the country. Mr. Strong is at present in Europe, engaged in bringing his invention to the attention of foreign steam users, in which effort he is reported to have met with the most flattering success.

The Strong feed-water heater and filter is manufactured by the I. P. Morris Co., of Philadelphia, Pa.; the Westinghouse Machine Co., of Pittsburg, Pa.; and Thomson, Sterne & Co., Limited, London and Glasgow. The general sales manager is Mr. C. D. Wainwright, of 73 Kilby street, Boston, to whom all communications should be addressed.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

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Special Fair Number.

We desire to announce an extra edition of 10,000 copies of the October number of the MANUFACTURER AND BUILDER, for distribution at the various fall industrial exhibitions. We call the attention of our patrons and advertisers generally to the value of this special number, placing them as it will in direct contact with parties to whose attention they wish to bring their products; and as the greatest discrimination that is possible will be used in distributing the copies, they will be placed where they will be likely to be of the greatest service. Notwithstanding the large extra circulation of which advertisers will thus enjoy the benefits, our rates will remain the same as for our regular edition, and we will gladly furnish prices on any space for which figures are desired. Those wishing particular locations, should communicate with us as early as possible, as space is already being rapidly taken.

The Future of Electricity.

The more we learn concerning the protean agent, electricity, the stronger grows the conviction that it is destined to do for the next century what steam has done for this. The rapid progress that is being made at the present time in extending its applications, and in developing new and startling facts and principles relating to its manifestations, is the universal theme of comment and discussion throughout the civilized world. No field of inquiry was ever opened to the man of science that promised such wealth of possible discovery as this; nor has the inventor ever had so fruitful and apparently exhaustless a domain opened to him in which to exercise his ingenuity. It would be difficult to conceive of an invention more revolutionizing in its results than that of the telegraph, and it will probably remain for centuries the monumental achievement of man in his mastery of nature. It accomplished the annihilation of space and time in the interchange of thought, and carried the world forward in civilization centuries at a single bound. But in the light of recent discoveries, no man may venture to set bounds to the possibilities of future discovery and invention in this field of research; and marvelous as was the invention of the telegraph, the future may have discoveries and inventions equally marvelous in store for us.

The possibilities of electrical progress are well stated in the following extract from an interesting popular presentation of the subject of progress in electrical science. The quoted paragraphs are as entertaining in subject as they are happy in expression:

"It is not strange that so rare and wonderful a gift should suggest, in the use first made of it, a thousand others no less surprising and felicitous. At present, it appears entirely a matter of conjecture how far and into what various and remote details of the economy of life it will be carried. Whether it is not itself the principle of life is a question which science refuses to consider until our knowledge in that field of inquiry becomes more definite; but to the untechnical mind the theory offers itself as a plausible assumption if nothing more—so subtle, so intangible, so potent and yet so elusive, so like the mysterious hidden force which we call life in animals and plants, is this swift and secret power whose capabilities have as yet been only guessed at—like a veiled giant, with only a hand and a foot thrust forth, the full revelation of whose stature and strength is yet to come.

"It is difficult to foresee into what functions of civilized life electricity is destined to enter, or, rather, it would be hard to name any from which it will be excluded. Already we talk, write and travel by means of it; our streets and homes are illuminated by it, and it is an invaluable ally of the mechanician, the physician and the surgeon. We speak of it as a motor and an illuminating agent, although both of these applications of electricity are as yet in the experimental stage. Of their success and ultimate wide utility, however, there can no more be a reasonable doubt than of the progress toward perfection of any other of the useful arts. Whether it may not yet afford the solution of still another formidable problem—the heating of buildings, and in general the supply of heat for domestic and mechanical purposes—is a question not yet practically investigated; but there are evident reasons assignable why it may prove to be, if not a source of heat, at least a serviceable medium for its transmission. The recent triumphant success of the experiments made in the storage of electricity by M. Faure, the French scientist, who was able to send a million foot-pounds of electrical energy from Paris to Glasgow, snugly packed in a box, prepare us for any extreme of daring or eccentricity on the part of inventors in this field."

Industrial Emancipation of the United States.

In a recent editorial in this journal, we discussed the question of the importance of manufactures as an element of national greatness. We argued that so long as the industrial forces of a nation are directed to the production of the raw materials to supply the factories and workshops of foreign countries, that nation would never emerge from the condition of a subsidiary and dependent one. We argued, further, that the way to permanent greatness was by directing the industrial forces of our country into the higher channels of manufacturing, through which alone we could hope to emancipate ourselves from such dependence.

The *Herald* of recent date contained some very pertinent allusions to a similar theme, in which it refers to the growing anxiety in Great Britain respecting the gradual decadence of British industrial supremacy. This admission of uneasiness would appear to be very general when it is voiced by such influential journals as the *Quarterly Review* and the *Nineteenth Century*, and is full of instruction to our people, for this country, by the rapid development of her manufactures in extent and variety, is chiefly responsible for the unpleasant feelings of our cousins across the water. The United States were for many years the largest buyers of British manufactures; but during the past decade we have made such rapid strides in developing manufacturing industries at home, that in a vast number of important items we have greatly diminished the importation of foreign products, and in many others have fully succeeded in supplying our domestic wants; in others, and in a rapidly increasing measure, we are even successfully competing with foreign manufactures in their own markets, and in distant quarters of the world, where, until lately, no manufactured goods, save those of European, and especially of British make, had ever been seen. That Great Britain keenly feels the effects of the gradual loss of the American market for her manufactures which is making itself felt year by year by the steady diminution of her exports to this country, and that she has come to recognize in us a dangerous rival to her industrial supremacy in the near future, are facts with which every thoughtful observer of industrial and political affairs is familiar. They are abundantly shown in the almost constant dis-

quisitions, explanations and lamentations of the British press in treating of the present condition and future outlook of British industries; but more significantly in the persistent and offensive zeal with which her cotton kings and iron lords have endeavored in the past, and still continue in their efforts, to break down the benificent system of protection which has been the corner-stone upon which the structure of American manufactures has been erected.

The *Herald*, after quoting from the British journals named above, in which the writers come to the not very comforting conclusion that England is losing her industrial hold on foreign nations, makes the following sensible comments on the situation, which our readers will perceive is an echo of our expressions of a few months ago: "England has held an industrial supremacy to which she is no longer entitled, and which in time must pass from her grasp. She has been doing the manufacturing for countries which are now beginning to do their own manufacturing, and will do more and more of it as they grow older. A good illustration of this is afforded by cotton. Every year our manufactures of this staple are increasing, and this and other countries will depend less on English mills for made goods. Our annual cotton crop is now worth three hundred million dollars raw and six hundred millions manufactured. No nation will long give away this great difference. It is to our interest to manufacture our own cotton crop, and in time we shall do so. That England should permanently hold the supremacy which she now has in the cotton industry, is contrary to the fundamental principles of national economy. And what is true of cotton, is true of certain other things that might be mentioned."

Protection against Lightning.

One of our scientific contemporaries records what we consider to have been a remarkably fortunate escape from death by lightning of many hundreds of people gathered together beneath the roof of an immense building, which was entirely unprovided with lightning rods, though it stood alone and exposed, with lofty steeples and spires, as though inviting the thunderbolt that might have proved the death of hundreds of those who thronged its interior. The time of this occurrence was the 12th of July, when a heavy thunder-storm passed over the cities of New York and Brooklyn, accompanied by powerful and frequent discharges of lightning.

During this storm, the great sea-side hotel at Manhattan Beach was struck by lightning. The most remarkable thing connected with this circumstance, is the fact that, although several thousand persons were at the time beneath the piazzas and in the saloons of the great building, having been drawn thither to seek shelter from the rain, not a single person was either killed or injured. As subsequent investigation proved, this fortunate escape from what might have been a terrible loss of life, was purely accidental, for the great building, though well provided with other safety appliances and conveniences, was totally unprovided with the means of protection against lightning, and the course of the electric fluid (to use a convenient phrase) was determined entirely by the fortuitous position of a gas pipe, which, by good luck, happened to be out of the way of the throngs within the building. What the result might have been had the gas pipe —which served to carry off the electricity—been differently situated, can only be conjectured; but that it might have destroyed many lives, no one familiar with the destructive effects of the lightning stroke will be disposed to doubt.

The following is a brief account of the circumstances of this noteworthy case, which carries with it an instructive lesson: "A blinding flash and a deafening roar informed the multitude that the house had been struck. But none were injured. The building is 600 feet long, 100 feet broad, three stories high, and although well provided with almost every other convenience and apparatus for safety, no precaution in respect to protection from lightning had been adopted. The several spires or steeples that rise from different parts of the building, were surmounted by ornamental sprays or branches of iron, which would have formed excellent lightning rods had they been connected with the earth. After the storm, a careful examination of the premises was made, and it was found that the lightning had struck the iron ornaments of the central tower, run down the iron staff thereof to the wooden timbers within the spire, where the iron terminated; thence the electrical current continued down on the wooden rafters, splintering the same for a distance of about 30 feet to the ceiling of the topmost sleeping-room, where it burst through the plastering and took to an adjacent gas pipe, on which the current went to the ground without further damage."

The above account shows how narrow was the escape of the multitude within the huge caravansary from being the victims of another of Dr. McCosh's "dispensations of Providence." The account from which we glean the foregoing facts, for some inexplicable reason, dismisses the frightful peril which the human throng escaped, with a brief remark, but expresses suprise that the tower should have escaped destruction from fire, as the iron staff terminated in the middle of a mass of dry timber.

It strikes us very differently. Some one, either the architect who designed the building, or the proprietors, assumed a fearful responsibility in erecting a huge structure like this one, standing alone and exposed, with lofty towers, to invite the thunder-bolt, but not a single provision to protect it from its destructive effects. The plea of oversight or ignorance on a subject which imperils human lives by the hundred, cannot be entertained. We are more than astonished—we are horrified at the criminal negligence displayed by some one whose business it was to have provided this building with the simple but efficient means of protection which every school-boy knows are necessary to guard it against this very common and often destructive element of danger. Let us hope that the lesson of the storm of July 12th has not been lost on the proprietors of the Manhattan Beach Hotel. If there are others to whom this admonition may come who are equally censurable, we trust each and all will not fail to take the lesson to heart and "put his house in order."

Extending the Utility of the Signal Service.

The suggestion has been made to extend the utility of our already very efficient Signal Service by adding to its scientific labors the work of making systematic observations respecting the electrical condition of the atmosphere. The proposal is that these observations shall be made, as meteorological observations are now made, simultaneously by a large number of competent observers over large areas, in order that the general laws respecting the connection of the electrical state of the atmosphere with meteorological conditions—which connection is known to exist, but is very imperfectly understood—may be worked out and formulated. It is known, for example, that the prevalence of certain winds along our coasts is usually accompanied by peculiar electrical states of the air; and the coming of these winds can be predicted, even in the present imperfect state of our knowledge, by observations on the electrical state of the air. With respect again to thunder-storms, it has long been known that their advent is almost invariably preceded by pronounced electrical disturbance, which could frequently, if not always, be recorded upon delicate electrical apparatus, with a clear sky and sunshine above.

The important practical bearing of these facts upon the meteorological work now being carried on so successfully by our Signal Service observers is too obvious to require explanation. The great progress in meteorology that has been made during the past decade, has been almost entirely due to the adoption of the plan of making systematic and simultaneous observations over very extended areas; and the little that we at present know of the relation subsisting between the electrical state of the atmosphere and meteorological phenomena, is sufficiently suggestive to justify the opinion that highly important scientific and practical results would follow the establishment of electrical observing stations in connection with those of the Signal Service.

The suggestion of extending the operations of the Signal Service by incorporating a system of electrical observations into the routine work of its numerous observers, has frequently been mooted by scientific men and discussed at scientific gatherings. While the great interest and almost certainty of valuable practical utility that would result from this extension of the work of the Signal Service has been universally admitted, no steps have as yet been taken on the part of the government to put the idea into practical shape. The proposed extension of the duties of the Signal Service would entail a large increase in the annual expenditure of the corps; and it is plausibly argued that the government would not be justified in incurring this yearly addition to its expenditures until the utility of the new scientific observations to commerce and agriculture shall have been demonstrated. In view of the very strong probability, in the light of our present imperfect acquaintance with this interesting subject that great benefits would result from the new departure, the argument just stated appears to be exceedingly weak; but happily a way has been found out of the difficulty which promises to solve it and to place the subject of electrical observations before the government authorities in such shape at an early date, as to command their attention and support. The plan in question is embraced in a recent proposal that a number of our leading scientific institutions shall coöperate with the Signal Service in putting this work into practical shape, and thus test its utility. The plan has, we believe, been very favorably considered, and we may hope to see it in practical operation at an early date.

Prof. John Trowbridge, of Harvard University, who has taken great interest in the subject, has written a very interesting account of the proposed plan of coöperation, from which we glean the following facts. He says:

"Since our knowledge of meteorological phenomena depends upon simultaneous observations extended over large areas, a number of stations for observing the electrical state of the air should be established in connection with the Signal Service. The practical difficulties, however, in establishing such stations are great. Each station would require an original outlay of not far from $1,000, and the salary of an observer must make part of the yearly expense of the station. This observer must be an experienced man, of a higher grade than the assistants in an ordinary meteorological station. In view of the large expense for equipping and maintaining such electrical stations, it is not probable that the Signal Service will establish them until it has been shown that the observations from such stations possess great importance to commerce and agriculture.

"By a simple plan of coöperation with the Signal Service, Harvard University, Yale, Columbia and Princeton colleges, the University of Pennsylvania and the John Hopkins University could enable the United States government to try the experiment of establishing electrical stations with the minimum of expense. The expense of erecting suitable buildings and of providing experienced observers, could be greatly diminished if each institution would furnish observers and suitable rooms. These institutions form a cordon of nearly a thousand miles along the Atlantic coast where commerce is most active. It is probable that they would be relieved of the routine work necessary for simultaneous observations on the electrical state of the air, when it had been shown that such observations are valuable from a commercial point of view; for as soon as the universities have performed their high function of leading in scientific inquiry, and the results affect the daily pursuits of mankind, new observations in meteorology, which require special scientific inquiry in physical laboratories, should lead the Signal Service to again extend its observations."

American Enterprise in Mexico.

Mexico is undergoing a wonderful transformation at the hands of American enterprise and capital. It is estimated that in the incredible short space of seven months, $68,000,000 have been invested in railways and mining enterprises from the United States, and yet it is said that the Spanish organs, and some of the Mexican journals, continue to utter warnings against the influx of Americans.

New Upright Drill Press.

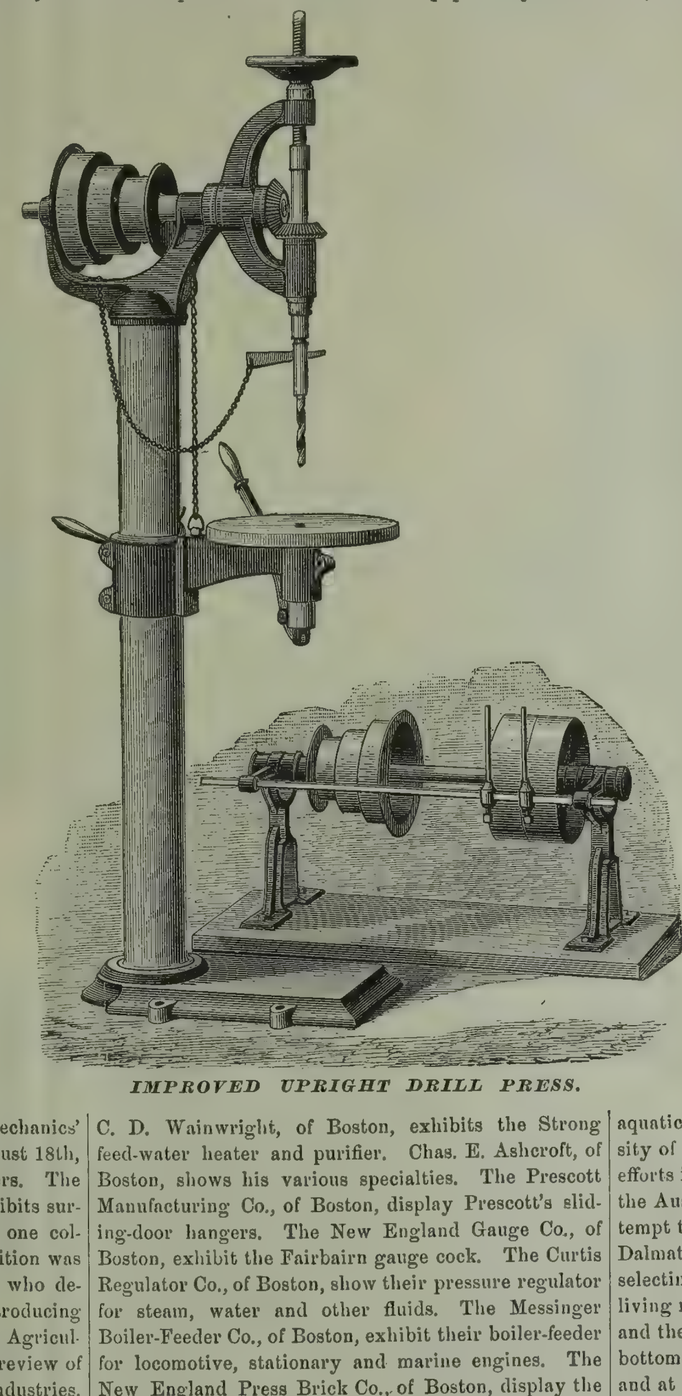
The accompanying illustration represents a new and improved upright drill press, designed and manufactured by Mr. W. P. Davis, of North Bloomfield, N. Y., and which is characterized by a number of mechanical features which render it a highly convenient and efficient tool for the machine shop. Its special features will be understood from the following description.

The drill has a 4½-inch column, and will swing 20 inches on the face-plate. The distance from the end of the spindle to the base table is 48 inches. The diameter of the face-plate is 14 inches. The weight of the sleeve and face-plate is accurately balanced by a counter weight inside the column, and attached to it by a chain passing over a pulley at the top of the column. By pushing down or raising up the handle, therefore, the sleeve and face-plate may readily be raised and lowered. The spindle is of steel, and is held in an arm that is made to swing over the same as a planer head, thus making it possible to drill work at any required angle. The table can be swung around the column, and also turned on the sleeve, if desired, so that the tool will drill at any point on the face-plate without requiring the work to be readjusted. The drill is provided with a screw-feed or hand-wheel, which has a brass nut, and the spindle is connected to the screw with a brass cap nut. Each drill is provided with a chuck, adapted for the Morse taper shank drills, but any other can be fitted to it. The gears are cut, the spindles and screws are made of steel, and the sleeve is made to fasten with the handle by clamping to the column.

In connection with the screw-feed, this drill has a lever-feed for small, quick drilling and counter-sinking, by the use of which, on many jobs, double the amount of work can be turned off that can be done with the ordinary screw-feed. The drill is provided with counter shaft, pulleys, hangers, belt-shifter and hanger-plank complete, ready to attach at once.

In the design and construction of this machine, it has been the effort of the maker to produce a tool of reasonable price which should be capable of turning out accurate work, and which should be characterized especially by its simplicity and ease of manipulation.

From the foregoing description, our mechanical readers will be able to judge how completely the claims of the maker are realized.



IMPROVED UPRIGHT DRILL PRESS.

Fair of the New England Manufacturers' and Mechanics' Institute.

The New England Manufacturers' and Mechanics' Institute exhibition opened in Boston on August 18th, and fully sustains the promises of the managers. The number and beauty of arrangement of the exhibits surpasses anything that has ever been shown in one collective display in New England. The exhibition was opened by Governor Long of Massachusetts, who delivered an eloquent address, and closed by introducing Hon. Geo. B. Loring, U. S. Commissioner of Agriculture, whose speech comprised an interesting review of the progress and present status of American industries. A feature of the opening day and evening was the presence of the governors of a number of States at the exhibition, and afterward at what was designated as the governor's dinner.

Among the many fine exhibits of steam engines, we notice the Hartford Engineering Company's new Buckeye, built at Hartford, Conn.; the Porter-Allen, built by the Southwark Foundry & Machine Co., Philadelphia; the Fitchburg, built by the Fitchburg Steam Engine Co. at Fitchburg, Mass.; the Kendall & Roberts, of Cambridgeport, Mass.; the Exeter Machine Co.'s engine, built at Exeter, Mass.; and one built by the Swamscott Machine Co., of New Market, N. H.

The Knowles Steam Pump Works, of Boston, have a splendid display, showing several forms of their celebrated pumps. The Salem Foundry & Machine Co., of Salem, Mass., are well represented by a very fine exhibit of their various specialties, prominent among which we note their improved furnace grate-bars. The Walworth Manufacturing Co., of Boston, exhibit a number of the manufactures for which this well-known house is celebrated. Mr. B. F. Sturtevant, of Boston, is on hand with a rich display of fan-blowers and exhaust-fans, exhibiting several handsome styles. The Crocker Filter Co., of Boston, exhibit their reversible self-packing and self-cleaning filter and purifier. The Hancock Inspirator Co., of Boston, display the Hancock inspirator and the Scoville pop safety valve. C. D. Wainwright, of Boston, exhibits the Strong feed-water heater and purifier. Chas. E. Ashcroft, of Boston, shows his various specialties. The Prescott Manufacturing Co., of Boston, display Prescott's sliding-door hangers. The New England Gauge Co., of Boston, exhibit the Fairbairn gauge cock. The Curtis Regulator Co., of Boston, show their pressure regulator for steam, water and other fluids. The Messinger Boiler-Feeder Co., of Boston, exhibit their boiler-feeder for locomotive, stationary and marine engines. The New England Press Brick Co., of Boston, display the excellent Gregg brick machine. A. F. Upton, of Boston, exhibits the Jarvis furnace for setting boilers. Geo. H. Corliss, of Providence, R. I., exhibits a model of a sewage pumping engine. Merrill & Woodbury, of Boston, exhibit a hot-air engine, which drives the electric lights with which the outside front of the building is lighted. The Billings & Spencer Co., of Hartford, Conn., exhibit drop forgings in great variety, both rough and finished, including wrenches, screw drivers, tool handles, lathe dogs, ratchet drills, head screws, gun and sewing machine trimmings, pliers, jewelers' anvils, etc. The Fairbairn Grate Co., of Boston, exhibit Fairbairn's hollow grate bar. Goodnow & Wightman, of Boston, have on exhibition a fine line of small tools for machinists' use, together with a variety of hardware. W. C. Young & Co., of Worcester, Mass., among other specialties, exhibit engine lathes. The Providence Tool Co., of Providence, R. I., exhibit an extensive assortment of screws, nuts, washers, links, etc., together with guns, rifles and machines for sewing leather.

Among other exhibitors are the following, all of whom have admirable displays: The Hawkins Machine Co., Boston; Nathan & Dreyfus, New York; T. J. & T. H. Gifford & Sons, Salem, Mass.; Fisher & Norris, Trenton, N. J.; Merrill Bros., Brooklyn, N. Y.; Ross Loom Co., Boston; Washburn & Moen Manufacturing Co., Worcester, Mass.; Chapman Valve Co., Boston; GiffordBros, Hudson, N. Y.; Curtis & Marble, Worcester, Mass.; National Water Meter Co., New York; Union Water Meter Co., Worcester, Mass.; Continental Water Meter Co., Boston; Boston Water Meter Co., Boston; Boston Hydraulic Motor Co., Boston; National Water Wheel Co., Bristol, Conn.; Cranston & Co., Brooklyn, (E. D.,) N. Y.; The Acme Co., Boston; S. B. Everett, Boston; I. B. Davis & Son, Hartford, Conn.; Geo. Frost & Co., Boston; Geo. Draper & Sons, Hopedale, Mass.; Kitson Machine Co., Lowell, Mass.; C. E. Kimball, Boston; Ashton Valve Co., Boston; Stanley Rule and Level Co., New Britain, Conn.; Young & Wheeler, Boston; James Smith Woolen Machinery Co., Philadelphia; Pettee Machine Works, Newton Upper Falls, Mass; Ezra Sawyer, Worcester, Mass.; Mason Machine Works, Taunton, Mass.; H. W. Butterworth & Sons, Philadelphia; Johnson & Bassett, Worcester, Mass.; Crompton Loom Works, Worcester, Mass.; Lowell Machine Shop, Lowell, Mass.; Prouty Press Co., Boston; George F. Blake M'f'g Co., of Boston; Stilwell & Bierce M'f'g Co., of Dayton, O.; Crosby Steam Gauge & Valve Co., of Boston; Pratt & Whitney Co., of Hartford, Conn. The Deane Steam Pump Co., of Holyoke, Mass., exhibit an independent condenser, arranged to connect with the Hartford engine when it is run condensing; Hill, Clarke & Co., of Boston, exhibit the Otto silent gas engine.

Artificial Propagation of the Sponge.

From the recently issued report of Prof. Baird, the Fish Commissioner of the United States, we glean some very interesting facts regarding the recent development of sponge culture. Among the more recent enterprises in the way of the artificial propagation of aquatic animals, Prof. Oscar Schmidt, of the University of Grätz, has been so successful in his preliminary efforts in the artificial propagation of the sponge, that the Austrian government have authorized him to attempt the development of the industry on the coast of Dalmatia. The process is very simple, consisting in selecting the proper season in the spring, dividing a living marketable sponge into numerous small pieces, and then fastening them to stakes driven into the sea bottom. These fragments at once begin to grow out, and at the end of a given time each one becomes an entire sponge. According to Prof. Schmidt, three years is a sufficient length of time to obtain from very small pieces fair sized sponges. In one experiment, the cost of raising 4,000 sponges amounted only to $50, and this included the interest for three years on the capital employed.

To Magnetize a Steel Bar.—A steel bar held in the direction of a magnetic needle, and struck several blows with a hammer, will become magnetized.

Improved Freight and Passenger Elevators.

Fig. 1.—No. 2 SCREW MACHINE—ERECTED.

The convenience and economy of elevators and hoists for passenger and freight service, in the saving of time and labor, have come to be so generally known and acknowledged, that at the present time no large business building or hotel is considered complete or desirable without one or more of them; while in mercantile and manufacturing establishments they have long come to be looked upon as indispensable for the rapid and convenient handling of goods and freight. The requirements of first-class machines of this class demand that they shall be simple in construction, durable in service, not liable to derangement, that they shall possess an excess of strength beyond any reasonable demand they will be called on to meet, and, above all, that they shall realize the conditions of absolute safety as nearly as possible. These requirements are by no means simple and easy of realization. The makers of elevators had much to learn that could only be taught by experience, and during the twenty years or so that have passed since the introduction of the passenger elevator, this class of machinery has been vastly improved upon, by the expenditure of much care and ingenuity, until at present it has been brought to a very creditable state of perfection.

We illustrate in the accompanying engravings, and describe in what follows, several forms of the elevators manufactured by L. S. Graves & Son, of Rochester, N. Y., who have gained considerable repute as representative manufacturers of this class of machinery. The firm in question manufacture all varieties of hoisting machinery, including power, hydraulic and hand elevators. Our illustrations represent two varieties of the power machines, the screw and geared machine, and the hydraulic machine for passenger service. The manufacturers, in the variety of the machinery they build, have endeavored to meet the various requirements of elevator service. The kind of elevator to be adopted will depend upon the location, the character of the building, the nature of the business, and the power most convenient to drive it. What would be best for one set of circumstances, therefore, will not be suitable for another. The manufacturers of these machines, therefore, recommend their steel screw machine (of four sizes) where parties have steam or power in their building, and want a first-class, noiseless-running elevator, wholly or in part for passenger use. Where a machine is desired for heavy freight uses, as in a manufactory or machine-shop using power, and where the running of toothed gearing is not objectionable, the makers recommend their geared machines (of three sizes), as answering the purpose best. If in a hotel, commercial building, drygoods, clothing or similar establishment, where power is not wanted or used for other purposes, and where the city or town is supplied with a system of water works at a pressure of from 25 to 100 pounds, and charges are not extravagant, they recommend their hydraulic elevator. In such cases, the cost of the last named would be much less when compared with that of putting in and maintaining steam power. The heat, steam, smoke, danger from explosion, increased insurance, etc., would also be avoided.

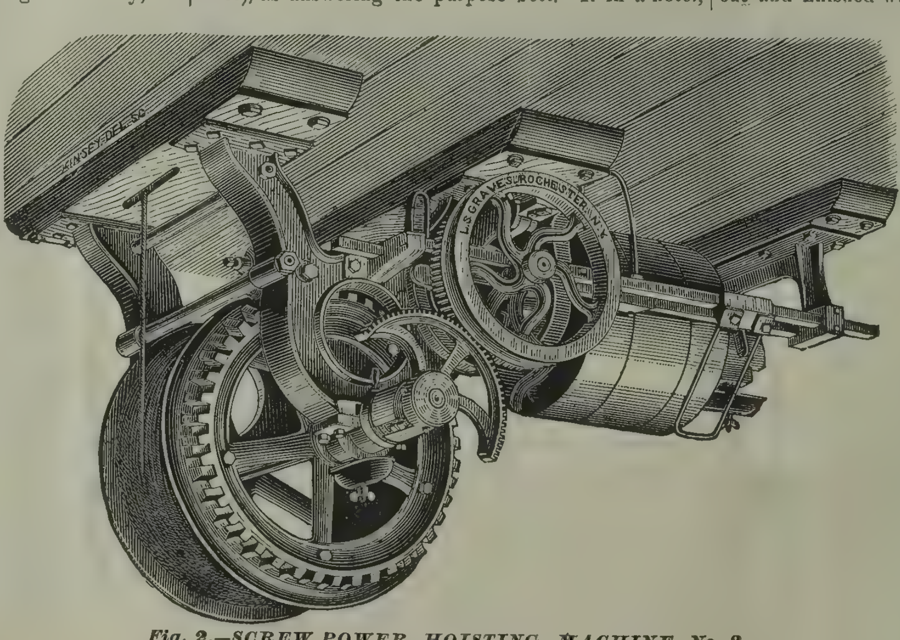


Fig. 2.—SCREW POWER HOISTING MACHINE, No. 2.

Coming back, after these preliminaries, to the description of the special machines named in the foregoing, we invite attention to Figs. 1 and 2, which represent respectively the No. 2 screw machine erected and in operation, and the hoisting mechanism of the machine. The machine is shown in use as a freight elevator, but can readily be transformed into a passenger elevator by substituting a passenger car in place of the open platform. In either case, the hatchway should be completely enclosed from top to bottom, by a wire screen or glass-panel doors on each floor, to be opened only from the inside by the attendant on the car or platform. Side or corner platforms are used, according to the necessary location of the machine.

The position and location of the winding machine, also, can be varied to suit the location of the driving shaft in the building. Fig. 1 shows its general arrangement, when secured to the floor overhead, in its working position.

These machines are equally well adapted for freight and passenger service. They run smoothly and noiselessly, are not liable to become disordered, are very durable in service, and consume the minimum of power. The screw is made of cast steel, forged solidly upon the driving shaft, and cut and finished with special tools. It runs on three hard Babbitt, self-oiling bearings, placed above the worm-gear, which concentrates all the strain on the strongest parts of the frame, and carries the pulleys and belt high out of the way. The worm-gears are made of copper and tin proportioned for the hardest anti-friction metal, and are exposed where their condition can be seen and examined at all times. These machines are fitted with an improved automatic stop motion, which is adjusted to the hight of the building, and prevents the winding drum from making more than the number of revolutions required to take the platform from the bottom to the top, where it is automatically stopped, without any connection with the shipping ropes. The loose pulleys have long bearings lined with composition sleeves, and have large self-oiling chambers.

Screw machines Nos. 3 and 4 are constructed on the same principle as No. 2 above described, but are larger,

and adapted for the heavier and more expensive class of freight and passenger service. With these elevators, the winding machine is built to rest upon the floor or foundation close to the hatchway, where it will be more accessible and likely to receive better care and attention. Fig. 3 represents the hoisting mechanism of the No. 3 screw machine. These machines are constructed of the same materials, and are provided with the same special appliances as the No. 2 machine above described.

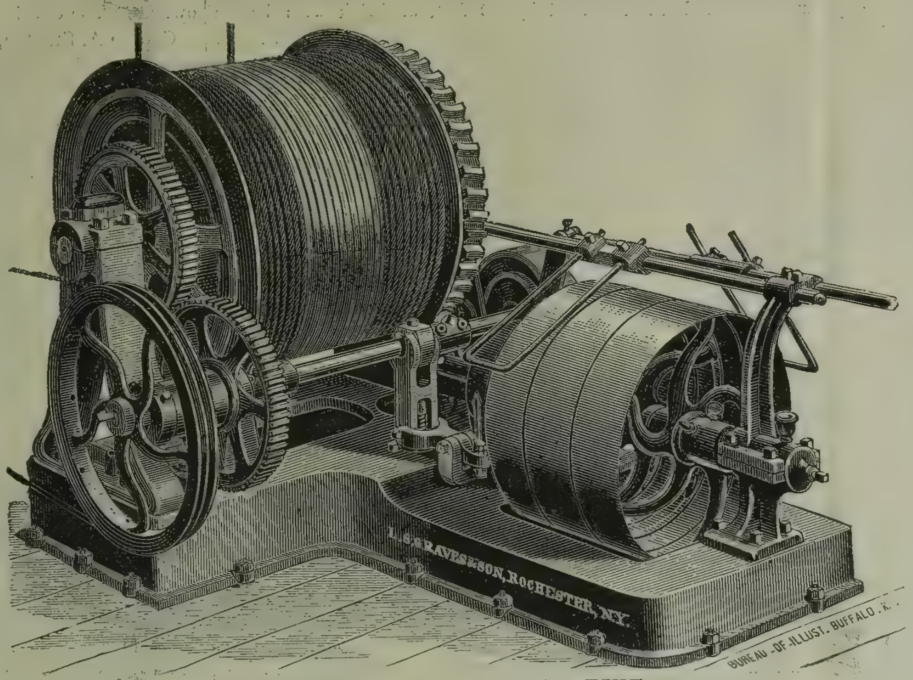


Fig. 3.—No. 3 SCREW MACHINE.

Fig. 4 represents the mechanism of the geared elevator No. 3, made by the same firm. These machines, while not suited for passenger service by reason of the noise and jar attending the working of toothed gearing possess all the requirements of simplicity, strength and durability which are needed in a freight elevator, for which they are specially designed.

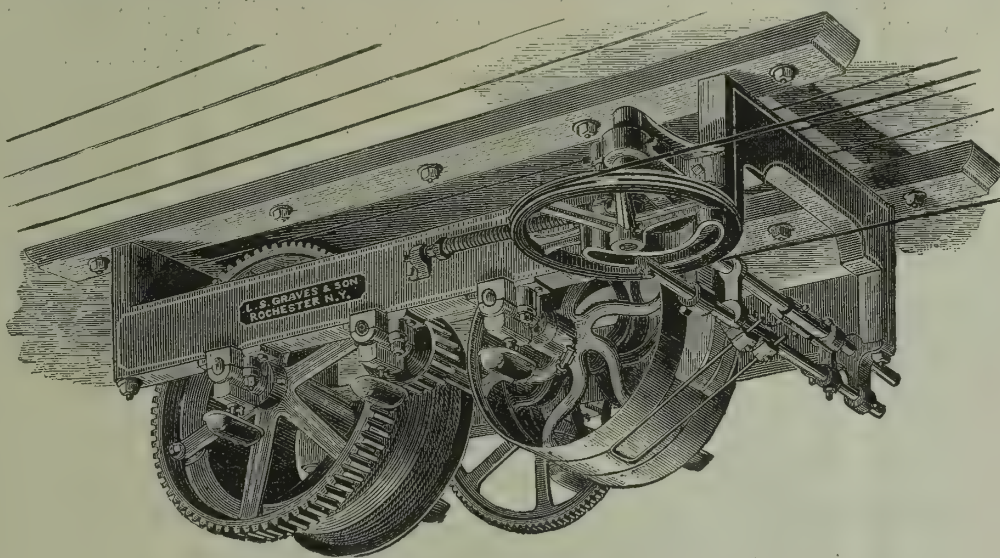


Fig. 4.—No. 3 GEARED MACHINE.

Geared machine No. 3 has a 24-inch winding drum, screw geared, to receive the wire rope. The gearing is heavy, and runs comparatively noiselessly. The journal boxes are long, Babbit-lined, and have self-oiling reservoirs and oil drippers. The loose pulleys have long bearings and self-oiling chambers. A double cam and two shipping rods permit each belt to be moved separately, rendering them easier to operate and with less wear than with the usual way of shipping both belts when it is only desired to move one. A heavy steel spring, with screw adjustment, is used to put on the brake and hold the load, and also serves the purpose of bringing and holding the belts to their proper places on the loose pulleys. These machines are provided with a safety governor, designed to avoid the danger of their running down suddenly with a load in case the belt should break or the brake become deranged. Its operation is such that should the platform from any cause go down faster than its usual rate of speed, a powerful brake is brought to bear on the pulley shaft, keeping it within a safe speed of descent. When it is down, the governor returns to its former position.

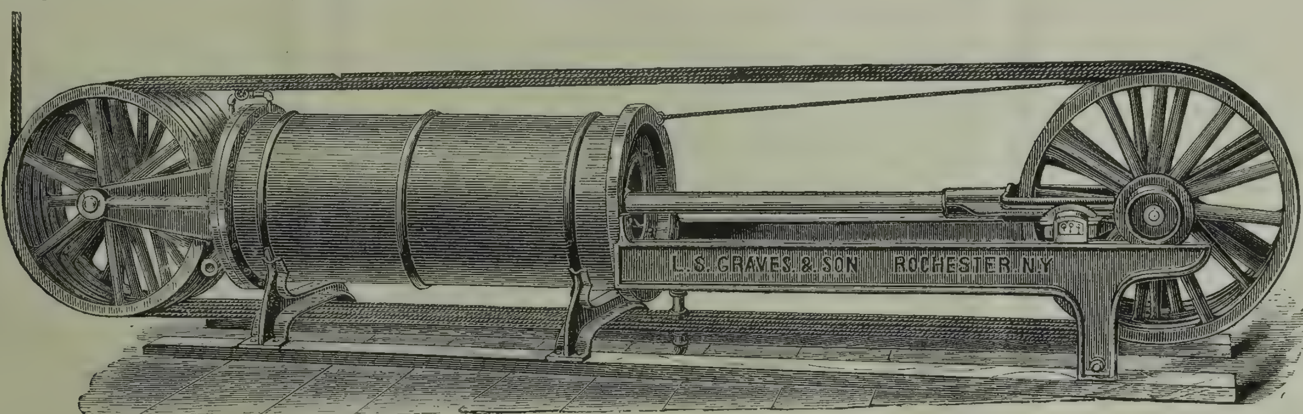


Fig. 5.—HYDRAULIC ENGINE.

The hydraulic elevator has, by general consent, come to be recognized as the passenger elevator *par excellence.* The general advantages of this system over the use of steam power have been briefly referred to at the outset of this article, and have been fully detailed in previous articles that have appeared in this journal. They do not, therefore, require to be rehearsed in this connection.

Messrs. L. S. Graves & Son, in inviting attention to their special build of hydraulic elevators, lay stress on the fact that they prefer to build the horizontal hydraulic engine with the continuous wire rope and sheave system. In behalf of this preference, they claim that this form of engine best serves the requirements of the hydraulic elevator in respect to safety from accidents, economy of water, simplicity and freedom from derangements, and durability in service. Furthermore, the engine, valve and connecting pipes are set upon heavy timbers or masonry upon the basement floor—high, dry and clean, and easy of access for oiling or repairs. The working parts, the piston and its connections, are carried on wheels and run on iron rails, perfectly balanced in any position. If necessary to economize room, a shelf or bench is built directly over it for the storage of goods. Also by its position in the basement or sub-cellar (generally the least valuable room in the building), it receives the maximum pressure from any source of supply, whether it be a tank on the roof or from the street mains, as the pressure, or the working power, is due to the hight of the source of supply from the hydraulic engine, consequently the manufacturers guarantee the greatest possible lifting capacity from the amount of water used.

In some forms of the upright hydraulic engine, where they are confined to the basement, they require to be set several feet below the surface, which is very objectionable in many respects. In other forms more commonly used, the cylinder and working parts extend up the whole hight of the hatchway, necessitating about one-third larger hatchway for the same size car than it would if these parts were confined to the basement, occupying from 10 to 20 square feet on each floor of the most valuable room in the building; and as these working parts, weighing many hundred pounds, are suspended high above the head, besides being very unsightly, are suggestive at least of serious accidents.

Fig. 5 represents the medium size hydraulic engine manufactured by this firm.

To meet the demands of an increasing business, the firm of L. S. Graves & Son have lately removed to a new and much larger building, supplied with additional accommodations and facilities. This building is located

at the corner of Center and Front streets, Rochester, N. Y. The building is 108 by 50 feet in area, having four floors containing over 2,000 square feet of flooring. The basement is appropriated to the department of casting and forging, and the general preparation of cast and wrought iron used in the construction of passenger and freight elevators, boot and shoe machinery, etc. The first floor is devoted to the machine-shop, and is equipped with new and improved lathes, drills, and other mechanical appliances used in making the gearing and machinery needed to operate elevators. The upper floors are used for pattern-shop and woodworking departments, for the manufacture of platforms for freight elevators and cars for passenger elevators.

The elevators of this firm have been very largely introduced, being in especial demand throughout the Eastern States. Over one hundred are at present in use in Rochester alone. They are likewise in very general use in New York city, Hartford, Albany, Troy, Syracuse, Utica, and other important localities, and have made a good record wherever they have been introduced.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

Plans have been filed for a grammar school building at the southeast corner of Lexington avenue and Sixty-eighth street, 60 by 120 feet, four stories high, of brick, and to cost $100,000.

G. B. Pelham is preparing plans for a large double flat to be erected in Fifty-seventh street, between Ninth and Tenth avenues. It is to be 50 by 90 feet, six stories in hight, and built of Philadelphia brick and Wyoming Valley freestone. The cost is to be $45,000.

William Rankin is about to build a large apartment house on Forty-seventh street, between Eighth and Ninth avenues, from plans prepared by John Rogers. It will be 25 by 70 feet, five stories high, and built of brick with brown stone front. The cost is to be $15,000.

Plans have been filed for the new Columbia College Library building, to be erected on the north side of Forty-ninth street, between Madison and Fourth avenues. It is to be 120 by 106 feet, three stories high, with an eight-story tower, of brick. It is to have Potsdam stone trimmings, and will cost $250,000.

Starkweather & Gibbs have made plans for a large building to be erected on the corner of Astor Place and Broadway. It will be 83 by 107 feet, seven stories high, with basement and sub-cellar, and constructed of brick and terra-cotta. The ground floor will be used for stores, and the upper stories for hotel purposes. Orlando B. Potter is the owner. The cost will be $225,000.

D. & J. Jardine have nearly completed plans for a large building to extend through from One Hundred and Fifth to One Hundred and Sixth streets, west of Ninth avenue. It will be 90 by 180 feet, three stories high, and constructed of brick, sandstone and terra-cotta. It will be heated by steam and have passenger elevators, together with all the latest improvements. It is to be known as the Home for Aged and Infirm Hebrews, and will cost $110,000.

John J. Burchell is going to erect two houses on Fifty-seventh street, 100 feet east of Ninth avenue, from designs by Frederick R. Barus. They will be 37 feet 6 inches by 87 feet, five stories in hight, and built of brick with brown stone fronts. The cost is to be $40,000. On Fifty-eighth street, 100 feet east of Ninth avenue, Mr. Burchell will build two more houses, 37 feet 6 inches by 75 feet, five stories high, of brick and stone fronts. F. R. Barus, architect. The cost is to be $40,000.

On the south side of Eighty-eighth street, 165 feet east of Madison avenue, William F. Burroughs is about to build three first-class private dwellings. They will be three stories in hight with basement, 17 by 53 feet, and extension 14 by 30 feet, of brick with brown stone trimmings. They are to have hardwood cabinet throughout. The back parlors will be lighted from the top with cathedral glass, which is to be divided into panels. The cost is to be $54,000.

The Washington Hotel, at Broadway and Battery Place, has been purchased by Cyrus W. Field, who has also purchased from the Astors the property between the rear of the hotel and Greenwich street. The two lots have a frontage of 66 feet 2 inches on Broadway, 171 feet 11 inches on Battery Place, and 65 feet on Greenwich street. It is Mr. Field's intention to build a ten-story fire-proof building of iron upon the lots. The cost of the building is estimated at $500,000. It is understood that a part of the building will be leased as a hotel, that the *Mail* will have its quarters in the building, and that the rest will be fitted up and leased as offices.

On the north side of Eighteenth street, between Ninth and Tenth avenues, on the site of the old Greenwich Pottery (the first ever built in New York), John Glass will build six five-story double flats, 25 feet 8 inches by 60 feet, from designs by G. B. Pelham. They will be constructed of brick and trimmed with Portland stone. On each floor there will be room for two families. A striking and novel feature about these flats is the entrance tower in front, containing iron staircases, which will extend to the roof. Above the roof the tower will be capped with a slate or tin pinnacle 20 feet in hight. The construction will be done by day's work, under the personal supervision of Mr. Glass. The cost is estimated at $75,000, exclusive of the land.

The Inspector of the Bureau of Buildings, in his report for the second quarter of the present year, shows the following facts: Plans were filed for the construction of 927 buildings, to cost $17,568,255. Among them were plans for 3 dwellings to cost more than $50,000 each; 44 to cost from $20,000 to $50,000 each, and 272 to cost less than $20,000. There were 13 flats to cost $15,000 and upwards each; 264 tenements to cost less than $15,000 each; 26 stores to cost $30,000 or more each; 8 to cost between $15,000 and $30,000; and 51 to be erected for less than $15,000; 10 office buildings at an expense of $2,333,200; 32 workshops at $336,350; 3 churches at $91,000; 4 municipal buildings at $115,000; 46 stables at $368,500; 8 places of amusement at $415,000; 13 frame structures, in the annexed district, at $23,625, and 9 other frame structures at $10,500.

The large grocery house of Francis H. Leggett & Co., on West Broadway, Franklin and Varick streets, is about completed. It has a frontage of 250 feet upon these streets, and has an area upon each floor of 10,000 superficial feet—equal to four city lots—and is nine stories in hight. The walls are 3 feet thick in the cellar and 2 feet 8 inches above, of the best Haverstraw brick, laid in English Portland cement. The entire first story is of granite, from the patent light stoop up to and including the cornice; from thence to the eighth story the fronts are faced with Philadelphia brick, with granite sills, sill courses, bands and lintels. The ninth story is formed by a mansard roof, which extends around the entire three streets. This is constructed of fire-proof materials, and faced with rich dark-red slate. On the corner of West Broadway and Franklin street a granite tower with polished columns is one of the features. The entire sidewalk is vaulted on the three streets, and covered with large granite blocks 12 inches thick. The cellar floor is 6 feet below tide-water, but is made thoroughly water-proof by heavy cement concrete work. There are six freight elevators, two 40-horse double-deck boilers, and an 80 horse-power engine. George W. du Cunha is the architect.

Miscellaneous.

Kimball & Wisedell have made plans for a block to be erected at Hartford, Conn. It will be 104 by 110 feet, four stories high, and constructed of pressed brick, molded brick and terra-cotta. On the first floor will be six stores, on the second offices, and on the third and fourth apartments. J. J. & F. Goodwin are the owners. The cost is to be $75,000.

George A. Stanton, of Nyack, N. Y., is about to convert his stables into a cottage. It will be built in the Queen Anne style, and cost $5,000. Horace G. Knapp is the architect.

Kimball & Wisedell have completed designs for a brick and tile house, to be erected at Waterbury, Conn., for Dr. Rodman. It will be 50 by 50 feet, three stories high, and is to cost $12,000.

Cleverdon & Putzel have just finished plans for a house at New Haven, Conn., 20 by 65 feet, and four stories high. It is to be built in the German Rennaisance style, and will cost about $15,000.

Thomas Stent has made plans for an agricultural implement factory to be built at Bayonne, N. J. It will be 1,000 feet in length and from 100 to 150 feet in width, and constructed of brick and stone.

D. A. Burr is about to build a fine residence at Montclair, N. J., from designs by Henry R. Searle. It will be a 3-story frame house, 50 by 50 feet, built in a style bordering on the Queen Anne, and is to cost $8,000.

On Black Mountain, at Lake George, N. Y., Cyrus Butler will build a three-story pinnacle stone house, 30 feet in diameter, from plans made by H. R. Searle. When completed, it will form the signal station for Verplanck Colvin's survey.

Franklin Chamberlain will build a red granite house at Hartford, Conn., 48 by 52 feet, with extension 19 by 29 feet, and two stories high, with roof, from plans draughted by Kimball & Wisedell. It will be trimmed with red brick. The cost is to be $20,000.

Two pavilions are soon to be built for the Flatbush Insane Asylum, in Brooklyn, N. Y. Plans have already been completed, which will be submitted to the Board of Supervisors. Each pavilion is estimated to cost $6,500, and will accommodate 40 persons.

At the southwest corner of Lee avenue and Rutledge street, Brooklyn, N. Y., James Healy is to erect four flats from plans drawn by I. D. Reynolds. The corner building will be 23 by 73 feet, four stories high, with stores underneath, and of brick with brown stone front. The other three will be 19 by 50 feet, two stories and basement, and constructed of brick with brown stone fronts. The entire cost is to be $20,000.

The new St. Mary's Hospital, in Brooklyn, N. Y., a part of which is now being built, will occupy, when completed, the entire block bounded by St. Mark's, Rochester and Buffalo avenues and Warren street. It fronts on St. Mark's avenue, the rear being in Warren street. It is designed to take the place of the building formerly used as dwelling houses at 155 Dean street, now known as St. Mary's Hospital. Only one wing—the western half of the building, in St. Mark's and Rochester avenues—will be built at present, owing to the lack of money. The building is of brick with granite facings, and is plain and solid in appearance. When completed in accordance with the plans, it will have a frontage of 500 feet and a depth of 229 feet. The main building will be in the middle of the block, in St. Mark's avenue, and will be occupied by the community of Sisters, while at each of the four corners of the square will be similar buildings of smaller size, 48 feet square. The wing will be five stories high, and the square buildings one story higher. The wing now building is 156 feet long in St. Mark's avenue and 229 feet in Rochester avenue. It will contain between 90 and 100 private rooms, 8 public wards, and 2 wards for special cases. In the square building at St. Mark's and Rochester avenues, will be a private entrance for patients. In the Warren street tower is the entrance to the dispensary and a private entrance for the physicians. The full plan of the hospital contemplates a very complete institution. The front and open spaces in the center will be nicely laid out with grass plots and flowers. Cook-houses and laundries will be placed back, and separated from the wards and hospital rooms by walls, and the quieter patients and convalescents will be remote from the more severe cases.

Demas Lathe and Universal Slide Rest.

In continuation of our previous reference to the excellent wood and metal working tools manufactured by A. H. Shipman, of Rochester, N. Y., we place before our readers the following additional description of specialties for which this establishment is noted.

Fig. 1 represents the "Demas Lathe No. 4," a practical lathe for metal and wood, designed expressly for machinists, carpenters, cabinet-makers, dentists, pattern-makers, makers of honey-boxes, and others. It is well adapted for heavy, practical work, and, with its attachments, has proved itself to be an excellent machine, equally useful in the amateur's home or in the practical workshop. It can be run with steam if desired; and in construction and action is so simple that the most inexperienced can speedily master it. It is adapted for a great variety of work, chasing the smallest screw or turning a pulley from $\frac{1}{2}$ inch to 6 inches in diameter; and with its back gear and universal slide rest it makes a very complete machinist's tool.

It is especially recommended by its maker for wood-workers' uses, the claim being made in its behalf, that, with its sawing attachments, which can readily be adjusted when required, it is capable of executing an unlimited variety of work.

The lathe is sufficiently large and powerful to turn table legs or moldings 10 inches in diameter. The scroll saw will cut with ease 3 inches and swing in the clear 24 inches. Its table will tilt for inlaying or sawing on the angle. The buzz saw will cut $1\frac{1}{2}$ inches, or 3 inches by turning the piece over. The table is adjustable up and down, and has ripping and cross-cut slides. This lathe is built entirely of iron and steel, except the treadle, which is of ash. Hight of lathe bed from floor, $34\frac{1}{2}$ inches; to centers, $39\frac{1}{2}$ inches. Diameter of balance-wheel, 21 inches; weight, 50 pounds; it is attached to the shaft inside of the bearings, and the treadle connected to the shaft outside of the bearings and at both ends. The ways to lathe-bed are nicely planed up and head and tail block milled to fit. The spindle in the head block is made from $\frac{3}{4}$-inch steel; the boxes are adjustable, so as to take up any lost motion that may occur from continued wearing. The centers are fitted with taper shank. The cone pulley on the spindle is nicely turned up, and has two lifts the same as on the large balance wheel, and speed can be varied from 100 to 2,000. Greatest distance between centers, 30 inches; distance from centers to ways, 5 inches. Full weight of lathe, 130 pounds.

Fig. 2 is a representation of the universal slide rest, an iron turning attachment designed to be used with the Demas Lathe No. 4, just described. It is intended for turning up pulleys, small pieces of castings, and short lengths of shafting; it is nicely fitted up, and the maker guarantees that it will execute work in the most satisfactory manner. Capacity of cross feed, 2 inches; horizontal feed, $5\frac{1}{2}$ inches. It can be attached to the lathe bed so as to face off any sized pulley that can be chucked in the lathe, and it can be attached to any lathe. Weight of slide, 15 pounds.

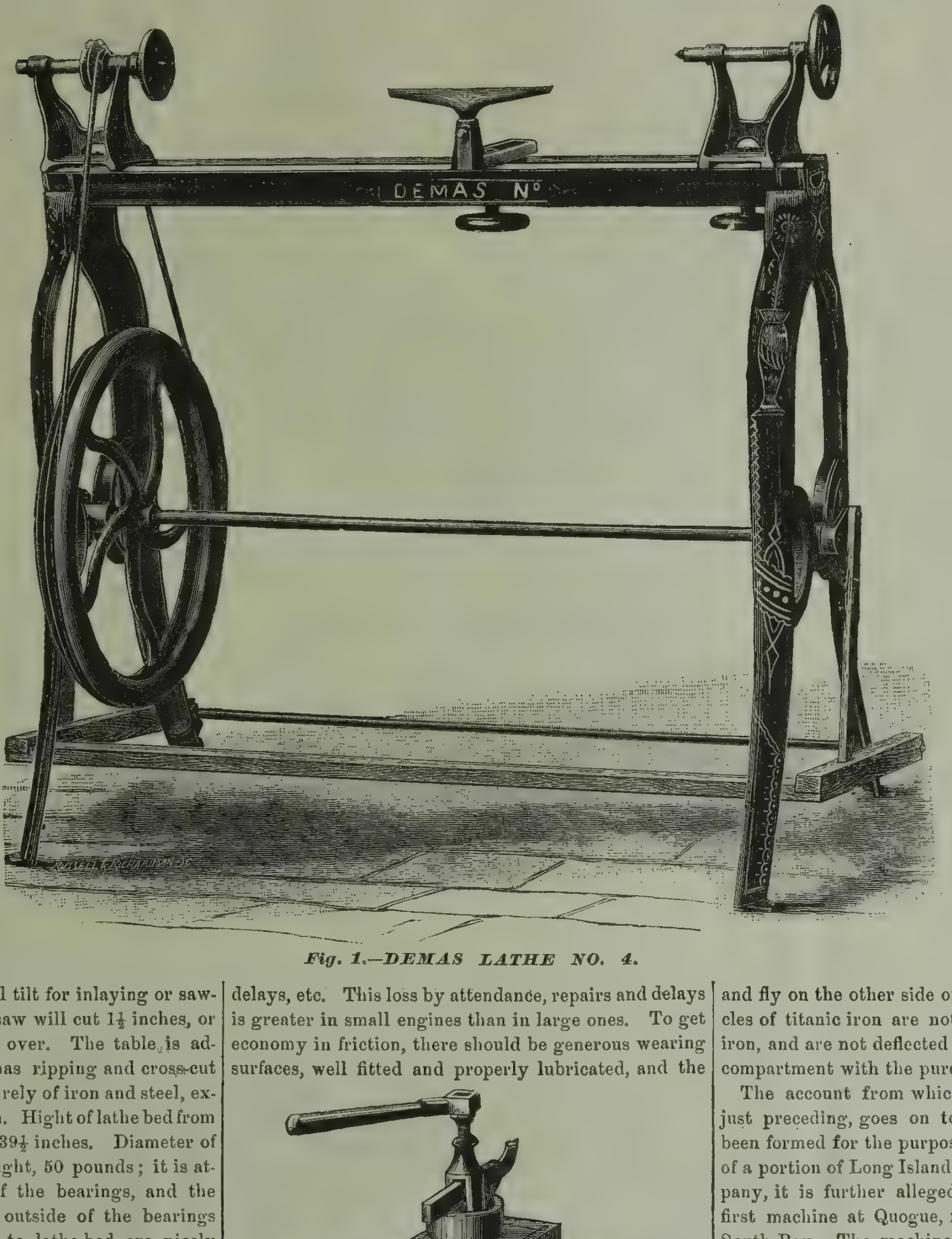


Fig. 1.—DEMAS LATHE NO. 4.

Friction.

So eminent an authority as Professor Sweet, says, in reference to the question of economy by reduction of friction, that of two systems, one offering a saving of 10 per cent by reduction of friction, and the other of 20 per cent in the use of steam, he would take that which led to a saving in friction, which of necessity implies saving in maintenance, attendance, repairs, delays, etc. This loss by attendance, repairs and delays is greater in small engines than in large ones. To get economy in friction, there should be generous wearing surfaces, well fitted and properly lubricated, and the engine should be in absolute alignment. We often find shafts which are set in perfect line and remain so when at rest, but which are deflected by the strains put upon them while at work.

Fig. 2.—Universal Slide Rest.

Concentration of Iron Sand.

There are many localities where magnetic iron in the form of small particles occurs abundantly mixed with common quartz sand. Such iron sand is generally very pure, and would occasionally afford a valuable source of iron, were it not for the cost of its separation from the sand, and more particularly from titanic iron, which often accompanies it, and which is a very objectionable constituent of iron ores.

It is claimed now that the magnetic separator devised by Mr. Edison has been found to afford a method of cheaply and very completely solving this problem, and that with its aid, not only can the magnetic ore be completely separated from the sand, but also from the titanic iron. The separation of the last named substance is accomplished by taking advantage of the fact that it (titanic iron) is less magnetic than pure magnetic ore. When a powerful magnet is, therefore, placed in proximity to a thin stream of this mixed sand, falling from a hopper a distance of four or five feet, the pure iron ore being most magnetic, is deflected farthest from the vertical course, the titanic iron less, while the sand is not affected; consequently the materials are automatically separated, and accumulate in different compartments below. The following is said to be a description of the apparatus and method used: The sand falls a distance of four feet in a thin stream from a slit in a V-shaped box holding about a ton. Under this box is a receiver divided into two compartments, the dividing partition being placed nearly under the slit in the sand reservoir and parallel to it. If no magnet is brought into play, the sand all falls into one side of the box; but when a powerful magnet is brought near enough to act upon the falling shower, the pure iron particles are deflected in their fall and fly on the other side of the partition. The particles of titanic iron are not attracted equally with the iron, and are not deflected sufficiently to fall into the compartment with the pure iron.

The account from which we glean the description just preceding, goes on to state that a company has been formed for the purpose of treating the iron sands of a portion of Long Island by this process. This company, it is further alleged, is now at work with its first machine at Quogue, near Moriches on the Great South Bay. The machine employed is reported to be of sufficient capacity to treat one hundred tons of sand per day, producing about twenty tons of pure iron ore at comparatively little cost.

A Valuable Plastic Material has been introduced in Germany for ornamental and other purposes. Five parts of sifted whiting are mixed with a solution of one part of glue, and, on those two being well worked up into a paste, a proportionate quantity of Venetian turpentine is added, in order to prevent brittleness; a small amount of linseed oil is also put with the mixture, to obviate its clinging to the hands, and the mass may be colored by kneading in any color that is desired. The substance thus formed may be pressed into shapes and used for the production of bas-relief and other figures, and may be likewise worked by hand into models—the hands to be rubbed with linseed oil and the mass to be kept warm during the process. On becoming cold and dry, which takes place in a few hours, it is as hard as stone.

The Gaffney & Co. Boiler Explosion.

BY F. B. ALLEN.

On June 1st, 1881, one of three steam boilers upon the premises of Messrs. Gaffney & Co., Philadelphia, Pa., exploded, killing three persons and injuring a number of others. The front boiler head was shattered into four pieces, the line of fracture passing through the man-hole opening radially, and circumferentially through that part of the head adjacent to where the metal had been reinforced by the thickening up of the flange near its rim. The flange and head seam remained intact (see Figs. 1 and 4). The force of the explosion destroyed the setting and projected the boiler in almost a direct line, and demolished the building in which it was placed, carrying away all obstacles in its path. It landed some 500 feet distant from its starting point.

The exploded boiler, known as No. 3, was of the plain cylinder construction, 3 feet diameter by 30 feet long, shell of full $\frac{1}{4}$-inch iron, plainly stamped in many places "Best Flange," T. S., 50,000 pounds. It was furnished to the boiler-makers, Sidebotham & Powell, Frankford, Philadelphia, by W. L. Bailey, of the Thorndale Iron Works, Pa. The heads were flat cast iron, $1\frac{7}{8}$ inches thick, filleted at flange. The man-hole in the front head was 11 × 15 inches, strengthened by a boss surrounding it, $1\frac{5}{8}$ inches wide by $2\frac{1}{4}$ inches thick. The feed entered through a nozzle in the front head, which also served as a blow-off. This boiler was built for a working pressure of 80 pounds steam, and placed in a brick setting alongside of Nos. 1 and 2 boilers by the same builders. It was in all respects a duplicate of the others, though built for a working pressure of 80 pounds, and subjected in the shop on completion to a hydrostatic pressure of 115 pounds by its makers. The pressure never exceeded 65 pounds.

Fig. 1 shows the fractured head man-hole plate and guard. One of the four pieces of the head was taken away by direction of the coroner, to be tested. Fig. 2 shows the safety valve and steam pipe connections. Fig. 3 shows pipe connections, in which A A represent the safety valves; B, stop valve; C, steam gauge pipe; D, main steam pipe; E, steam nozzle; and G, stop valve, from the other two boilers. In all the cuts like letters refer to the same parts.

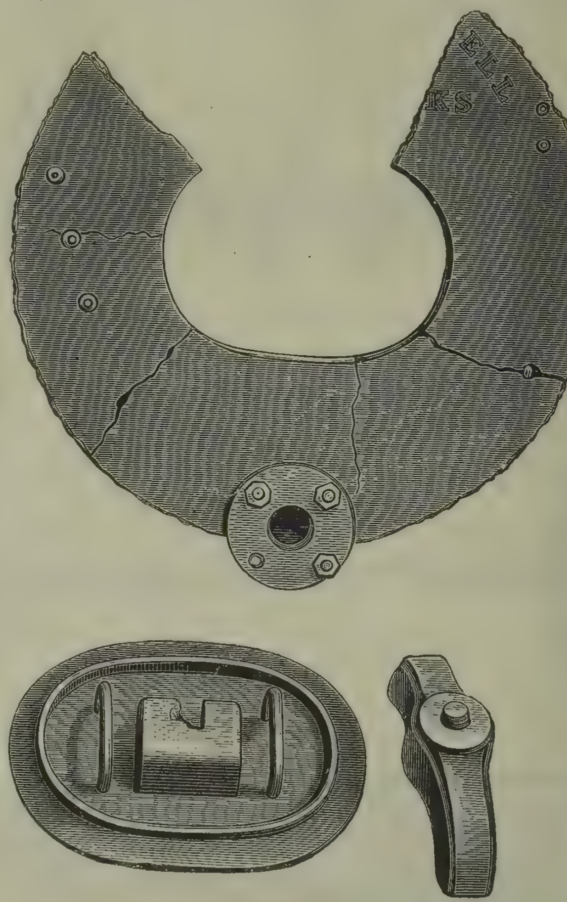


Fig. 1.

The pipe connections were so arranged that all the boilers could be used together when required to work at full capacity; or No. 3 boiler could be used singly if a less quantity of steam were needed. It had two common lever safety valves $1\frac{7}{8}$ inches in diameter, each independent of the other, attached to a forked connection of the steam pipe direct from the boiler without intervening valves (see Figs. 2 and 3). It had a separate steam gauge attached to the steam pipe shown at C in the cut. There were three common gauge cocks and a glass water-gauge upon the boiler front. The water gauge, it is reported, was inoperative, the glass having been broken a few days previous. A No. 6 Rue injector was used for feeding all the boilers. It was ample for the purpose, and gave no trouble. This boiler was internally and externally examined by an inspector of the Hartford Steam Boiler Inspection and Insurance Co., on March 2d, and a few days thereafter, when the pipe connections were completed, he subjected it to a hydrostatic test of 95 pounds per square inch, as required by city ordinance. The examination and test were both satisfactory, and it was accepted and insured by that company for a pressure of 70 pounds, at which pressure the two safety valve levers were cut off to prevent increase of valve load by shifting of weight, and the weights were set back so the valves both blowed freely at 65 pounds. At the time of this inspection, and for some eighteen months previous, the other two boilers had been in the care of a competent, experienced man, who regarded it as his first duty to take proper care of his charge, and, when not engaged in that work, assisted in other work as required. He was removed some ten days before the explosion, and the care of the boilers then devolved upon one of the workmen from the dye-house, who, it is believed, was untrustworthy in character, intemperate in his habits, and without mechanical qualification for the position. Of this change of engineers, the Hartford company had no knowledge until after the explosion.

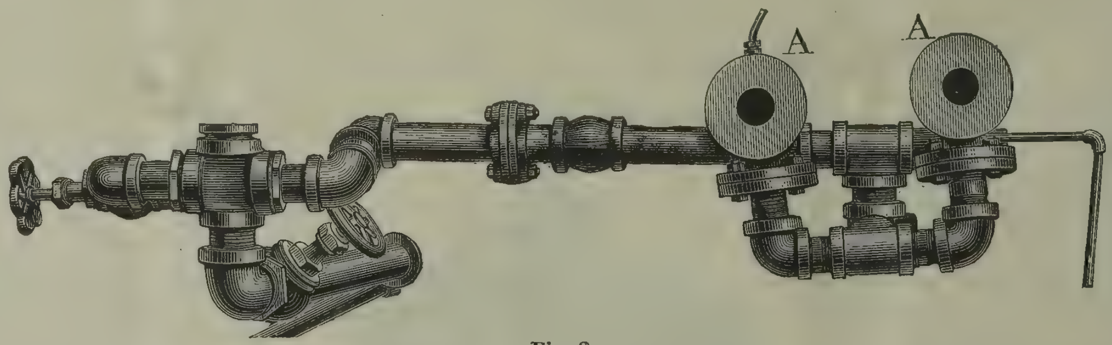


Fig. 2.

For some reason—possibly the absence of workmen and the celebration of Decoration Day—the usual quantity of steam was not required, and No. 3 boiler had been out of service, but was fired up by the night watchman (who took care of the boilers at night) about 7 o'clock P.M., May 31st. He had steam before midnight. Nothing of note occurred during the morning; but just before 12 o'clock noon, as was their custom, the fires were cleaned and covered with fresh coal, after which the engineer went to dinner. He returned to his work, and was engaged about the fire-room when the explosion occurred, about 12.45 P.M. He was buried under some of the debris, scalded and bruised. After his rescue and removal to the hospital, the deputy coroner called upon him for a statement as to what he was doing at the time.

His first statement was that he was engaged in wetting down the ashes. A few days after he denied this, and said he was stooping down looking into the furnace at the time. This last statement may be seriously doubted, in view of the complete destruction of everything in front of the exploded boiler.

The speculations and theories as to the cause of this explosion were numerous, the most important of which I purpose examining, endeavoring to ascertain how far they may be confirmed or disproved by the surrounding circumstances, and by the mute testimony of the wrecked boiler—by far the most convincing and conclusive to the thoughtful engineer, subject, of course, to our errors in interpreting its story.

As to low water, that there is no foundation for such a belief is evident upon an examination of the shell of the boiler, which bore no indications of overheating.

Was there an intervening valve between the safety valves and the boiler? This is also answered in the negative by the arrangement of pipe connections in Figs. 2 and 3. These pipes and fittings were taken from the ruins, put together, verified by measurement, and admitted to be correct by the steam fitter who put them up.

What was the effect of dashing cold water from a hose upon the cast-iron boiler head, heated to a temperature due to the steam pressure upon its interior surface? It will, I think, be readily admitted that this would be a dangerous and unwise thing to do. Remarkable cases might be cited in proof of this; but whether sufficient to have caused a sudden contraction and shattering of the boiler head is a mooted question that, I think, cannot be settled in the absence of other important data.

We may next consider the strength of the cast-iron head. During the time the writer was engaged in his investigations at the scene of the disaster, he had the honor of meeting a number of practical constructing engineers of that city, and others, strangers, who, like himself, came to study, and possibly to profit by the experience thus acquired. It was their opinion, so far as he heard it expressed, that the cast-iron head of No. 3 boiler was, to outward appearances, possessed of the requisite strength for a greater pressure than that allowed by the Hartford boiler inspector; and when they were informed that it had so recently, on two occasions, withstood without indications of weakness the proof pressures applied, it was agreed that an inspector had no other alternative than to accept such boiler and certify to its safety.

If our reasoning is correct and the foregoing theories are not confirmed by the facts, have we any clue to the cause? I think we have, and that it is in an over-pressure of steam, for the following reasons: When No. 3 boiler was stopped off a few days preceding the explosion, it was necessary to close the valve B, Fig. 3, upon the pipe that connected it with the other two boilers. After the explosion, it was recovered from the ruins and found to be *closed*, the wheel knocked off, and its spindle bent over close up to the packing nut, demonstrating beyond a doubt that it was in that condition at the time of the explosion. With the valve B, Fig. 3, closed as described, there were but two outlets for the steam—one to the dye-house and the other to

the safety valve. These outlets to the works were probably closed at noon when the men went to dinner. The steam would then accumulate, having no outlet, if for any reason the safety valves were inoperative. It will be recollected they were independent in action, their miter was such that the bearing did not exceed three-16ths of an inch, the valve resting on the top of its seat. They were not as liable to stick as a majority of safety valves in use. The fitting of the spindles and guides seemed to have been done in a workmanlike manner. Of course they were battered and bruised by the explosion, and allowance had to be made for that. Other things being equal, the danger of safety valves setting fast in their seats would be greater after they had been out of service for several days than when in use.

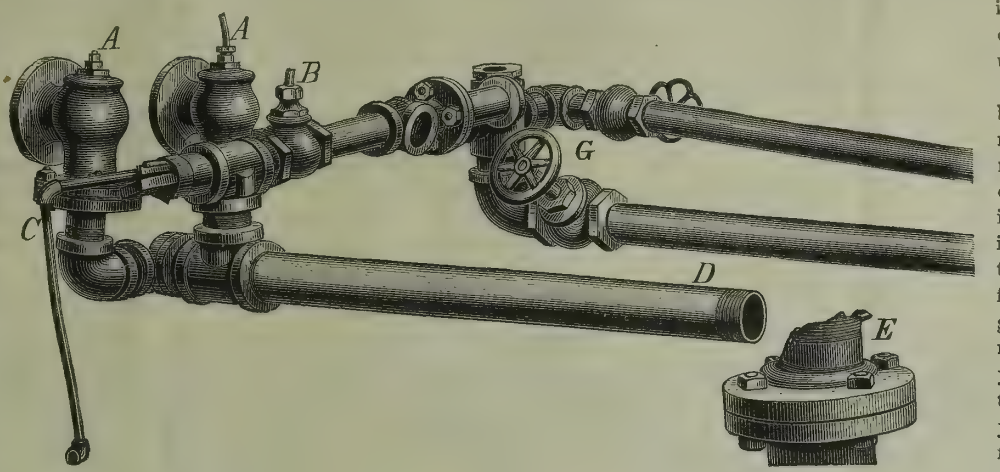


Fig. 3.

In this case, while there was but little probability of the safety valves A A sticking, owing to the unusual precautions observed in having two safety valves when but one is ordinarily employed, there was a possibility of their doing so, if not eased off their seats after steam was up. There is not a particle of evidence to show that this was done, or that the man at that time in charge of the boilers understood his business sufficiently to realize the necessity for it.

Much criticism has been provoked concerning the strength of cast-iron boiler heads, from the fact of the circumferential fracture (Figs. 1 and 4) revealing a place in the interior of the casting where the iron was "spongy," or weakened by "blow holes." This came like a new revelation to these critics. But, as a matter of fact, did we not know before that cast iron was peculiarly liable to such action? The initial fracture in this head occurred around the manhole plate, it seems evident, and in accordance with a well established law, it followed a line of weakness in running around the rim of the flange (Figs. 1 and 4). The path of the boiler's projection, and the fact that one of the victims met his death upon his own door-step, killed, it is reported, by the guard of the man-hole plate striking him in its flight, in a line from where the boiler started, and in the opposite direction, is a confirmation of that opinion.

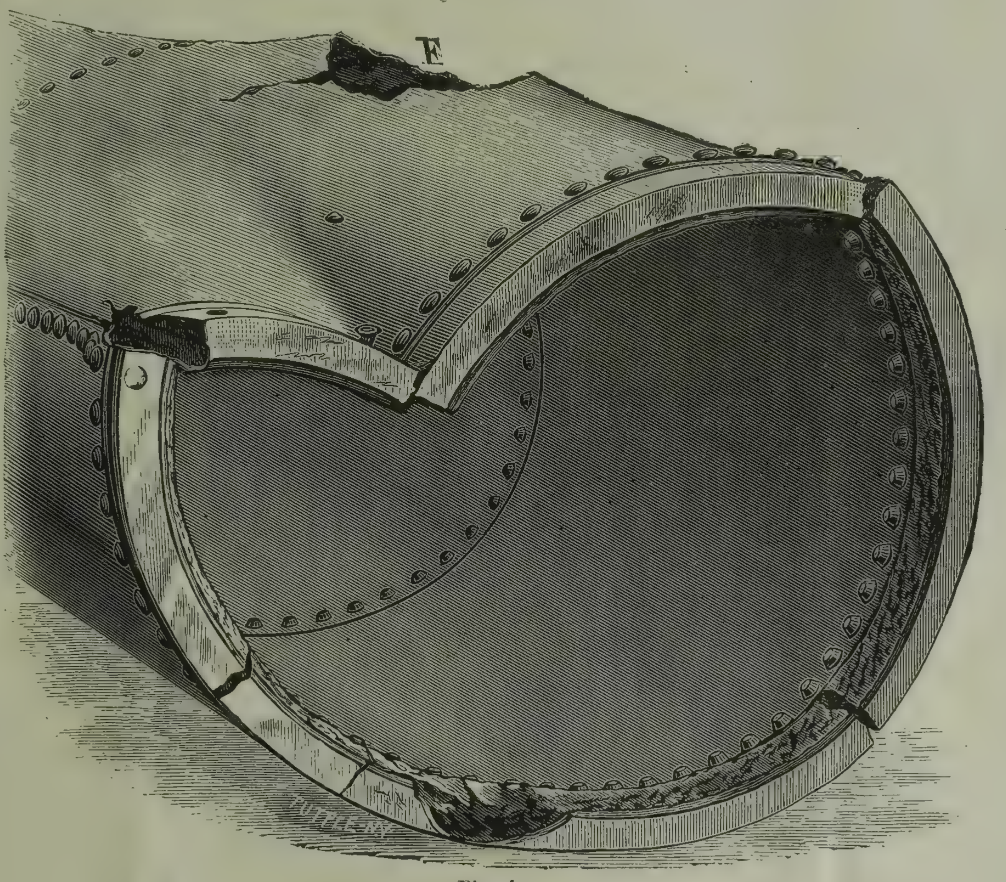


Fig. 4.

The foregoing statements of facts, obtained by careful examination of the various details of boiler and fittings, point unmistakably to the necessity of having properly qualified attendants in charge of steam boilers. It will avail but little, no matter how many safety appliances are attached to a boiler, if the management be in the hands of a negligent or incompetent person, who does not prove the efficiency of such appliances daily. He may understand firing and keeping the requisite quantity of water in the boiler, and yet be a dangerous man, if that be the extent of his knowledge. An intemperate man ought under no circumstances to be trusted with the care and management of steam boilers. It is peculiar that the latter circumstance, which I regard as the solution of the problem in this explosion, should have been dismissed with but very brief mention in the coroner's verdict. While disregarding the facts and evidence before them, they censure the boiler insurance company in the following terms: "The inquest consider that the Hartford Boiler Inspection and Insurance Company are especially censurable for the incompetence and negligence of its agents who inspected and certified to the safety of this boiler." They do not tell us wherein this alleged incompetency or negligence consists. Loud calls are now being made through the technical press that these gentlemen of the jury take the public into their confidence. Their verdict is flatly contradicted by their principal witness. I refer to the testimony of Mr. John Overn, Chief Inspector of Boilers for the city of Philadelphia. He said: "In the inspection, the boiler conformed to all the requirements of the city ordinances; the head was apparently good, as was the boiler. I know the inspector who tested this boiler, and consider him a remarkably competent inspector; would have passed this boiler and allowed 80 pounds steam pressure upon it."

Further comment seems unnecessary.

Water Gas.

This gas is quietly but steadily making advances, being used at the present time in not less than fifty cities and towns in the United States and Canada for illuminating purposes. In some of these, notably in Baltimore, the new process has driven the old coal gas process entirely out of the business; while in New York, it is affirmed that at least one-half the illuminating gas used at present is water gas.

In Europe water gas has been lately introduced with marked success as a fuel in metallurgical and other industrial operations; and the importance of this innovation is attracting widespread attention and comment. The friends and advocates of water gas as the "fuel of the future," may, and doubtless will, have years of bitter opposition still to confront; but with every year, the battle they are fighting becomes less fierce and the period of final victory less remote.

We have never doubted what would be the issue of the conflict which has been waged for years in this country against water gas processes for illuminating purposes, by the friends of the coal gas industry. This part of the battle has been fought and practically won, the substantial proofs of the victory being the use of water gas as an illuminant in fifty cities and towns as stated above, and the steady spread of its adoption year by year.

The great future of water gas, however, as we have often explained, lies in its introduction as a fuel for domestic and industrial uses, and in that direction little has yet been attempted in this country. In Sweden and elsewhere in Europe, water gas, manufactured by the "Strong" process, has been introduced as a fuel in a number of large industrial establishments, and with the most flattering prospects of success. The general use of fuel gas for manufacturing as well as for domestic uses, implies a thorough revolution in the methods of using fuel the world over. The innovation will continue to find every step of its progress bitterly contested, but the ultimate success of its friends and advocates is admitted by all progressive technologists to be simply a question of time. The high heating power of water gas; the cheap rate at which it can be manufactured, by reason of certain improvements; its convenience and cleanliness as compared with solid fuels; the ease and perfection with which its consumption may be controlled for any period, long or short, without waste, are but a few of the many advantages which gaseous fuel offers, and which in due time must force its general adoption in cities and town, factories and workshops.

The Friction of a Belt is double as much on wood as it is on cast iron.

The Jetty Works at the South Pass of the Mississippi.

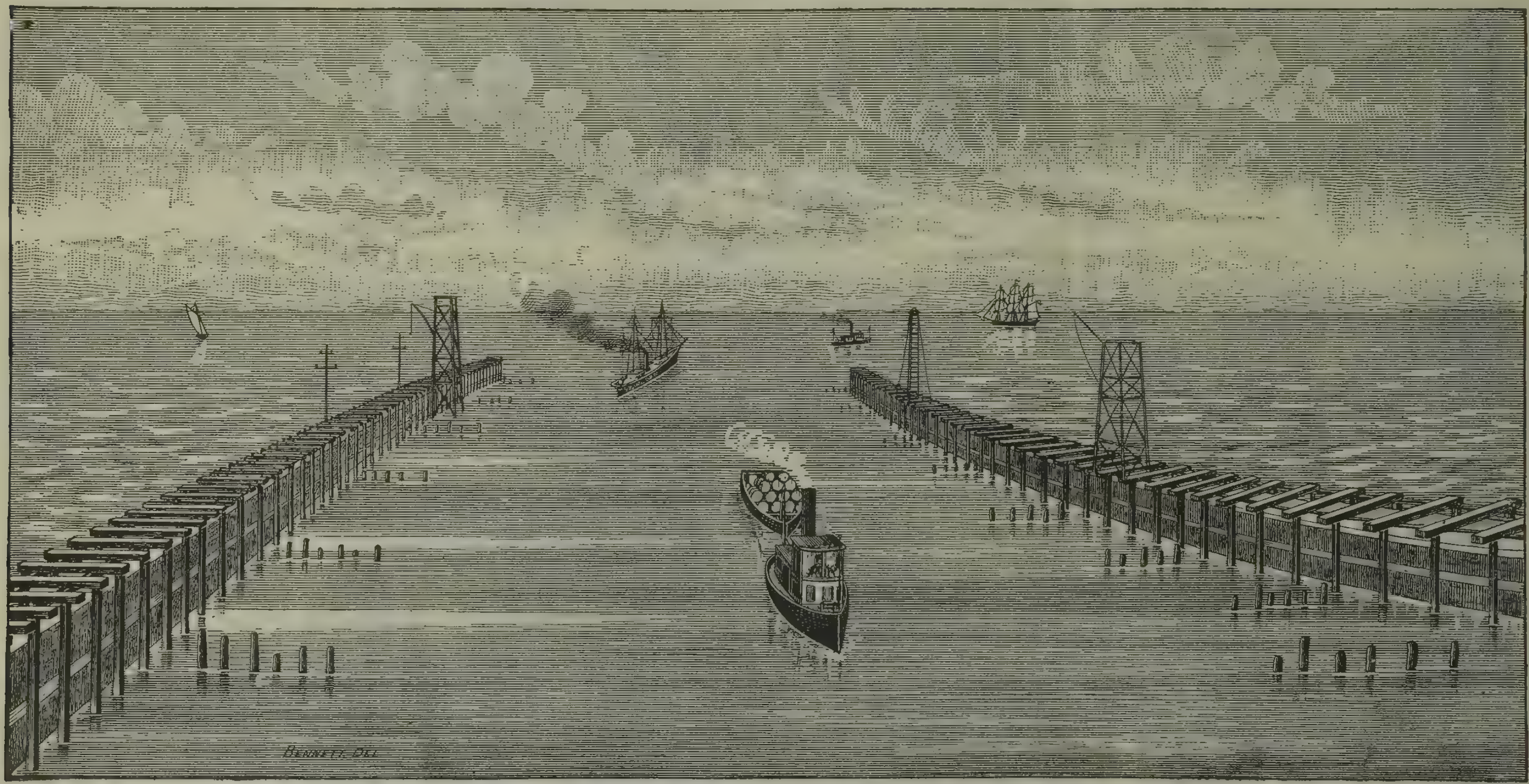
Of all the engineering works ever executed in the United States, none are to be compared in respect to boldness of conception and in the magnitude of the results proceeding therefrom, with the jetty works for improving the navigation of the Mississippi river, planned and successfully executed by Capt. James B. Eads. In view of the exciting discussion which the suggestion of Capt. Eads called forth in the engineering fraternity, and the strong opposition which it aroused among influential professional officials, the prosecution of the work to a successful termination in the face of peculiar obstacles, and in spite of the condemnation of the first professional authorities of the country, has won for its originator the unqualified admiration of his fellow-engineers, and a national renown.

We present in the following a brief history of the origin and character of this important work, with engravings showing the outlet of the jetties, for which we are under obligations to the *Leffel Mechanical News.* The great commercial interests involved in the maintenance of a deep, permanent channel from the Mississippi into the Gulf of Mexico, will be familiar to every reader. The great river drains twenty States and Territories, embracing an area of 750,000,000 acres of the richest agricultural districts of the country. It traverses the four great belts of wheat, corn, cotton and sugar, to say nothing of the minor products, the tobacco of the central South, the lumber of the far North, and the live stock and minerals of all sections. The importance, therefore, not only to the rich and growing States through which it passes, but to the nation at large, that this magnificent waterway of the continent should be maintained in a condition suitable for the cheap, rapid and uninterrupted conveyance seaward of the immense agricultural and other products of the rich countries which it drains, had long been recognized before the plan of Capt. Eads was presented. To understand the case properly, it will be necessary to give a brief statement of the condition of the mouth of the Mississippi previous to the construction of the jetties.

Like all great rivers, the Mississippi carries down with it to its mouth immense quantities of silt, or mud, robbed from the land which its tributaries drain. The quantity of solid matter conveyed by the river varies according to season, being greatest during the spring, when the melting snow and ice of the North swell the volume of the tributaries and the main river to enormous proportions, causing frequent and disastrous flooding of the adjacent low lands. This year, it will be remembered, the inundations were especially severe. At such times, the velocity of flow of the river is much greater than at ordinary periods, and consequently its power of transporting silt, or sediment, is correspondingly increased. Taking the average of one year with another, it has been estimated that the Mississippi annually pours into the Gulf nineteen and a half trillion cubic feet of water. This water carries from a half to three cubic inches of sediment along with every cubic foot of water. The aggregate of this solid matter is about 800,000,000,000 pounds per annum, a quantity sufficient to make every year a square mile of land 268 feet deep. As the river approaches the comparatively sluggish waters of the Gulf, its velocity of flow is diminished, and a portion of its transported sediment is deposited. The river here becomes a broad and shallow stream, entering the Gulf through half a dozen or more passes bordered by mud banks of its own creation, and which are gradually being extended further and further out towards the deep waters of the Gulf. From this it will be seen that the river is constantly making land at its mouth and extending itself gulfward. About 12 miles from its mouth, it divides into three branches, which run down like narrow tongues into the Gulf; on each side they are bordered by low, muddy banks, and between them the Gulf extends up in shallow embayments. At the Gulf extremity of these passes, the silt deposited from the sluggish current of the river forms a bar that is constantly being extended outward. The depth of the river gradually decreases as it approaches the Gulf. At New Orleans, the river averages over 100 feet in depth and about ¾ of a mile in width; this depth continues to the head of the passes where the river widens suddenly to a mile and a half, and shoals up to a depth of about 30 feet. At the mouth of the south pass, where the jetty works have been constructed, the depth of water over the bar at low tide was only 12 or 13 feet.

From these facts, the reader will perceive that the navigation of the great river was seriously impeded by the shallow water at the Gulf entrance, making it impassable save to vessels of light draft and small tonnage. It was to remedy this state of things, and to create a channel deep enough and wide enough to enable vessels of the largest tonnage to pass freely up and down the river, that the jetty works were projected; and this the jetties have thus far succeeded in doing.

The following statements will explain the nature of these improvements. The plan of the work is remarkably simple. The object sought to be accomplished was the removal of the point where the sediment of the river was formerly deposited—namely, in the shallow water at the entrance of the pass, further out into the deep water of the Gulf, where filling up again by natural causes will be an indefinitely remote possibility. To accomplish this object, Capt. Eads, against the judgment of some of the most eminent government engineers, proposed the adoption of a system of jetties, which had been found so successful in the case of the mouth of the Danube and other rivers of Europe. This system involved the extension of the banks of the pass, to carry the stream far enough out, by the creation of artificial walls within which the waters of the river would be confined, the said walls being so proportioned in width, to the quantity of water escaping, as to produce an increased velocity of current, and thus force the stream to scour out for itself a deep channel.



OUTLET OF THE JETTIES—PASSING INTO THE GULF.

After much discussion, the plans presented by Capt. Eads were approved by Congress, and he was authorized to proceed with the work under conditions, which, in consideration of the professional opposition to his plans, reflect the highest credit upon his engineering skill and foresight. By the terms of the contract entered into between the government and Capt. Eads and his associates, the work was to be undertaken at the sole risk of the last named. No payments were to be made by the government until certain stipulated depths of water had been secured and maintained for a certain period. The act of Congress provided that when a depth of 20 feet had been secured, a certain payment should be made, and so on up to 30 feet; that twelve months after each of the prescribed depths had been secured, a further payment should be made, provided that the same had been maintained during that time; and that a certain annual payment should be made during twenty years for maintaining the works after their construction, and for extending them if necessary, so as to keep the channel at the required depth.

Upon these terms the work was undertaken. Extensive lines of jetties were constructed along the course of the moving waters, to act as artificial banks

to the river to prevent it from expanding and diffusing itself as it enters the sea. The greatest difficulties to be overcome were to devise means for creating these artificial walls, and making them secure and permanent upon the exceedingly unstable foundation of soft sediment, into which any works of stone would speedily sink and disappear. Piles alone, or crib-work, however firmly placed, would soon be undermined and swept away by the scour of the accelerated current.

To meet these difficulties, Capt. Eads constructed the artificial walls of the river with broad, flat mattresses of willow brush, securely lashed together and anchored to an interior row of piles. The preliminary work was the driving of piles along and inside of the line of the proposed structure. While this was going on, great mattresses of willow brush were constructed, firmly locked together with cross-ties and pins. These mattresses were towed into position adjoining the piles and fastened to them. Within twelve or twenty-four hours, the deposit of sediment from the current so completely filled the interstices of the mattresses as to sink 8 feet. In addition to the jetties, the improvements of Capt. Eads comprise two auxiliary works—the closure of the Grand Bayou and the construction of a dyke at the head of the pass. The object of these works is to deflect more water into the South Pass and thus increase the velocity, and consequently the scouring action, of the current.

During the progress of this important undertaking, the observations made from time to time gave evidence of the correctness of the theory on the faith of which it was undertaken. The channel was found to continuously and steadily increase in depth as the lines of the jetties were extended, and within a brief period after their final completion, several years ago, a channel of 30 feet in depth for a width of 200 feet was satisfactorily secured, and has since been maintained without dredging, or other artificial aid than that afforded by the jetties themselves. The fear that the action of the jetties would simply have the effect of shifting the bar a little farther out, where it would again form and prove as great an obstacle to navigation as ever, has

BIRD'S-EYE VIEW OF PORT EADS AND THE MISSISSIPPI JETTIES.

them. Each mattress was not only fastened to others adjacent to it, and to the piles, but was also anchored to its place by a layer of stone. This simple plan was found to work most satisfactorily. It was found that the sediment continued to gather in upon the mattresses until they became more solid and enduring than any part of the natural bank. The wall of mattresses was found to perfectly protect the piles from the scour of the current, while the latter in turn served to hold the mattresses in place. When built up to a sufficient hight, the structure was crowned with a firm stone paving, and the outer ends of the wall, where they were exposed to the sea, were constructed of broader and stronger mattresses supporting solid and durable works.

The extent and location of the jetties are as follows: The lines of the jetties are 1,000 feet apart. The length of the east jetty, from the land's end to the jetty head, is about 12,500 feet. For most of its length this jetty is constructed on a lateral shoal, where the depth averaged about 6 or 7 feet. The west jetty, on account of the further extension of the river bank on that side, begins about 4,000 feet further down than the east one, and extends parallel to it out to the same point. At its beginning it was constructed in much deeper water than was the east jetty; the depth, however, gradually shoaled to the crest of the bar, where it was some 6 or not been verified, the sediment being most probably carried out sufficiently far by the rapid flow of the river as to cause it to be carried off and dissipated by the currents of the Gulf.

The completion of this important engineering work has established the unrestricted navigation of the greatest water-way of the continent. The largest ocean steamers can now enter and pass out of the river without difficulty. The commercial results flowing from the improvement of the Mississippi's mouth are of vast national importance. Already the work has given an immense impetus to the foreign commerce of New Orleans and other cities upon its banks. It has caused the diversion of a large and growing share of the vast grain traffic of the West from the great trunk lines of railway, and New Orleans, St. Louis and other cities upon its banks will speedily become dangerous rivals to the great Eastern cities for the exportation of the agricultural and mineral products of the West and South, of which the latter were formerly practically the sole possessors. The work of improving the navigation of the Mississippi, which Capt. Eads has accomplished in so signally successful a manner, although it has already greatly benefitted the trade of the Southern and Western States that border upon it, promises for the future to yield still greater results.

The Fleuss Breathing Apparatus.

The Fleuss respirator, which of late has attracted so much attention as a very substantial improvement upon the old apparatus used by divers for subaqueous work, has recently been applied by its inventor, in a modified form, as a respirator to be used in mines and other situations where the atmosphere is charged with irrespirable gases. In this form, it may be very useful in the exploration of portions of mines which are suspected to be dangerous, or for rescuing life after an explosion, or the like, since with its aid one may penetrate with impunity into any atmosphere without danger of suffocation. Experiments have been made with an apparatus of this description at the New Seaham colliery, near New Castle, England, and, it is said, with very satisfactory results. The modified apparatus is described as being of the size and shape of a soldier's knapsack, weighing only a few pounds, and consequently not inconvenient to carry. The principle of this respirator is the same as that of the Fleuss diving apparatus, already described in this journal, and consists in supplying the wearer with an air supply sufficient to last for several (4 or 5) hours, so that he is entirely independent of any external supply. The wearer is likewise provided with a very complete mask of rubber and leather, and glasses for the protection of the eyes.

The inventor has also devised a safety lamp on the same principle. It is expected that these devices will prove themselves to be very useful in the dangerous emergencies that so frequently occur in coal mining.

The Advantages of the Underground Telegraph now being laid in this city, are represented to be as follows: It is claimed for the underground wires that the cost is much less than any of the foreign systems, and that while it is greater than the above-ground wires, yet the system is much cheaper from its saving in cost of repairs and maintenance. The average life of the ordinary pole and line telegraph is eight years, and the cost of repairs and maintenance takes up one-fourth of the receipts. When the underground wires are properly laid, it is claimed that the cost of maintenance is inconsiderable. Moreover, the workings of the wires will be unaffected by the storms which now sometimes destroy all telegraphic communication between cities for a time.

New Facts Concerning the Sahara.

Dr. Lenz, an African traveler, who has recently returned from a lengthy exploration of that region, which comprised a journey from Morocco to Timbuctoo, the mysterious negro metropolis, expresses some entirely new views concerning the topography and other physical conditions of the Sahara, which have an important bearing upon the projects for converting it into an inland sea, which have for some years past been persistently urged.

So far from being a basin depressed below the sea level, he reports that the portion of the Sahara traversed by him—which is the region comprised in the flooding schemes—in reality forms a great plateau, about 1,100 feet above the level of the Atlantic. In no portion of this plateau was there any signs of the basin below sea level, which is spoken of and laid down in the maps by the advocates of the schemes for converting the Sahara into an inland sea.

With reference to the general character of the Sahara, he reports it as being much better than has generally been represented. It is not an arid sandy desert, but is quite diversified; in some portions rocky, and in others a sandy plain, with grassy oases and shallow sheets of water interspersed.

It is impossible to reconcile the widely differing statements of Lenz and of Mackenzie and other advocates of the Sahara Sea project; but in view of the fact that the former has actually gone over the ground he speaks of, his statements are entitled to greater credence. It will be interesting to see how Mackenzie and his friends will meet this new obstacle to their pet scheme.

Scientific.

STORAGE OF ELECTRICAL ENERGY.—Sir William Thomson, whose first reports upon the Faure accumulator attracted such universal attention, has continued his researches, and has obtained results which fully confirm the favorable opinion which he has expressed concerning the value of these batteries.

In a recent communication to the London *Nature* relating to this subject, he says: "I am continuing my experiments on the Faure accumulator with every-day increasing interest. I find M. Reynier's statement, that a Faure accumulator, weighing 75 kilogrammes (165 pounds), can store and give out again energy to the extent of an hour's work of one horse-power (2,000,000 foot-pounds), amply confirmed. I have not yet succeeded in making the complete measurements necessary to say exactly what proportion of the energy used in the charging is lost in the process of charging and discharging. If the processes are pushed on too fast, there is necessarily a great loss of energy, just as there is in driving a small steam engine so fast that energy is wasted by 'wire drawing' of the steam through the steam pipes and ports. If the processes are carried on too slowly, there is inevitably some loss through local action, the spongy lead becoming oxidized, and the peroxide losing some of its oxygen viciously—that is to say, without doing the proper proportion of electric work in the circuit. I have seen enough, however, to make me feel very confident that in any mode of working the accumulator not uselessly slow, the loss from local action will be very small. I think it most probable that at rates of working which would be perfectly convenient for the ordinary use of fixed accumulators in connection with electric lighting and electric transmission of power for driving machinery, large and small, the loss of energy in charging the accumulator and taking out the charge again for use, will be less than 10 per cent of the whole that is spent in charging the accumulator; but to realize such dynamical economy as this, prime cost in lead must not be stinted. I have quite ascertained that accumulators amounting in weight to three-quarters of a ton will suffice to work during six hours at the uniform rate of one horse-power, and with very high economy. I think it probable that the economy will be so high that as much as 90 per cent of the energy spent in the charge will be given out in the circuit external to the accumulator. When, as in the proposed application to driving tram-cars, economy of weight is very important, much less perfect economy of energy must be looked for. Thus, though an eighth of a ton of accumulators would work very economically for six hours at one-sixth of a horse-power, it would work much less economically for one hour at one horse-power; but not so uneconomically as to be practically fatal to the proposed use. It seems, indeed, very probable that a tram-car arranged to take in, say, 7½ hundred weight of freshly charged accumulators, on leaving headquarters for one hour's run, may be driven more economically by the electric energy operating through a dynamo-electric machine than by horses. The question of economy between accumulators carried in the tram-car, as in M. Faure's proposal, and electricity transmitted by an insulated conductor, as in the electric railway at present being tried at Berlin by the Messrs. Siemens, is one that can only be practically settled by experience. In circumstances in which the insulated conductor can be laid, Messrs. Siemens' plan will undoubtedly be the most economical, as it will save the carriage of the weight of the accumulators. But there are many cases in which the insulated conductor is impracticable, and in which M. Faure's plan may prove useful. Whether it be the electric railway or the lead-driven tram-car, there is one feature of peculiar scientific interest belonging to electro-dynamic propulsion of road carriages. Whatever work is done by gravity on the carriage going down hill, will be laid up in store ready to assist afterward in drawing the carriage up the hill, provided electric accumulators be used, whether at a fixed driving-station or in the carriage itself."

These expressions of the leading physicist of England, happily justify the hope that is very generally entertained respecting the practical value of this latest advance in electrical science, and warrant the favorable expectations we have entertained and expressed upon the subject in recent issues of this jouanal.

NOVEL MACHINE FOR DEMAGNETIZING WATCHES.—With the extensive use of dynamo-electric machines there arises a difficulty which is experienced by almost every one who comes into proximity to one of them—that is, the magnetization of one's watch so that its time-keeping qualities are seriously interfered with, or its stoppage complete. Several methods of demagnetizing watches have been proposed, some of which operate with a certain degree of success, but all are more or less troublesome and uncertain.

Mr. H. S. Maxim, the well-known mechanical and electrical engineer of this city, has lately perfected an apparatus which is exceedingly simple and perfect in its action, and it may be used not only on watches and other small machinery affected by magnetism, but also on tools of any form or size.

The device consists of a bar electro-magnet, mounted on a vertical spindle so as to revolve endwise in a horizontal plane. It receives a current from a dynamo-electric machine or galvanic battery, which is transmitted to the magnet wires through springs bearing on the insulated collars above and below the magnet, these collars being connected with the terminals of the magnet wire. The frame supporting the magnet spindle is attached to the end of a bed-piece having on its upper surface, ways for the carriage supporting the watch. This carriage is moved along on the bed-piece by a screw, having at one end a crank and at the other end a bevel wheel which engages with a pinion on the magnet spindle. The watch-holder is mounted on a hollow vertical spindle opposite the poles of the magnet, and takes motion from the screw through a bevel wheel fixed to its lower end, and driven by a pinion carried by the carriage, but rotated by the screw, the screw being slotted and the pinion being splined for that purpose. The watch-holder is supported by a frame attached to the end of the hollow vertical spindle, and a small wheel is supported inside of the watch-holder frame by a fixed shaft running downward through the hollow spindle and attached to the lower portion of the carriage. The chuck in which the watch is placed is revolved by a belt passing over a pulley on the end of its shaft, under guide pulleys and around the fixed wheel, so that as the watch-holder frame is revolved in a horizontal plane the watch is revolved in an ever-changing vertical plane.

The operation of demagnetizing a watch is very easy. The watch is placed in the holder, and the carriage is moved up as near the electro-magnet as possible. The shear nut on the carriage is then brought into engagement with the screw, and the magnet is rotated rapidly, the watch at the same time receiving a compound rotary motion which brings every side of the watch in opposition to the poles of the magnet. The electrical circuit is thus completed through the magnet by means of a switch at the side of the bed-piece, and the rotary motion is continued until the carriage has reached the end of the screw remote from the magnet, when the electrical circuit is broken and the work is completely done. A watch is so thoroughly magnetized by this operation as to be incapable of making a single stroke of the escapement lever. When it is taken out of the machine, its motion is perfectly free and normal, and the most delicate tests fail to reveal a trace of magnetism.

The theory of the action of this machine seems to be that the watch is subjected to rapid reversals of polarity in a gradually weakened magnetic field until the final reversals are practically *nil.*

ELECTRICITY AS A MOTOR.—With every passing month, the future possibilities of electricity as a motive power increase; and there can be no doubt that when the method of storing up supplies of this agent, which has of late been accomplished with gratifying success, shall have been further improved, we shall witness a vast extension of its use as a source of power for general and domestic purposes and for illumination.

The latest experiment in connection with the use of electricity as a motor, comes from Paris, where M. Trouvé, a well-known electrician, is reported to have devised and successfully applied a method of using electricity for the propulsion of a boat. The trials of this novel experiment were made on the Seine on several occasions, with a boat containing from two to six persons. According to the accounts that have appeared, M. Trouvé's electric motor consisted of a Siemens armature, supplied with two secondary batteries. This motor was connected by an endless chain in such a manner as to transmit its power to a three-bladed screw at the stern of the boat. The motor itself is fixed on the upper part of the rudder, which it follows in its movements, as does also the screw. The motor, with its accessories, does not weigh more than 5 kilogrammes. M. Trouvé's apparatus may be adapted to any boat, and there seems no reason whatever why it might not be so modified as to be applicable to vessels of much larger dimensions than that experimented on.

These experiments are interesting as showing what an extension of the applications of electricity we may look for when the methods of storing up large supplies of this agent shall have been brought to perfection. This last desideratum, in view of what has already been accomplished, is beyond doubt only a question of time.

ALCOHOL IN NATURE.—M. Müntz, a chemist of high repute, and director of the laboratory of the Agronomic Institute in Paris, has lately made the curious and unexpected discovery that arable soils, the waters of the ocean and streams, and the atmosphere, contain traces of alcohol; and that this substance, which is formed by the fermentation of organic matters, is everywhere distributed throughout nature. The quantity of this substance detected in his numerous experimental investigations was exceedingly minute, but the fact of its presence was demonstrated beyond question by very trustworthy chemical tests, and the discovery must be regarded as one of great interest.

M. Müntz made more than eighty experiments, and

each gave identical results. They were made with rain, snow and sea waters, arable soils, and with atmospheric air. The quantity of alcohol contained in rain, snow and sea waters was found to average from one to several millionths; cold water and melted snow were found to contain more than tepid waters. It was found in appreciable quantities in the waters of the Seine, and in decidedly increased quantities in sewage waters. Vegetable mold was found to be quite rich in alcohol, and the investigator expresses the opinion that in all probability alcohol formed in nature, has its origin in the soil through the fermentation of organic matters contained therein. After its formation in this manner, he conceives that it is disseminated through the atmosphere in the state of vapor, and is carried down with the aqueous vapors as they are condensed and precipitated in the form of rain or snow.

The results obtained by M. Müntz are the outcome of investigations extending over four years, and the experiments by which they were established were made in the most elaborately careful manner, which leaves no doubt of their strict accuracy.

Free Fluorine in Certain Fluorspars.—It has been known for a long time that a peculiar strong smelling substance was given off when the violet-black fluorspar of Wölsendorf was decomposed, and many conjectures as to its nature have been made. Some chemists ascribed it to calcium hypochlorite, some to ozone, and others to antozone.

Oscar Loew, whose attention was called to this subject, suspected that the odor in question was due to free fluorine, and on examining the investigations of other chemists who had worked upon the subject, he became satisfied that while they showed the impossibility of ozone being the cause of the odor, they did not preclude the possibility that it might be due to free fluorine.

Thus, it appeared that a temperature of 310° C. (590° Fah.) did not destroy the odor (that of ozone would be completely destroyed at that temperature); rubbing up the powdered mineral with caustic potassa solution changed it considerably. When rubbed up with sulphur, an odor like that of chloride of sulphur was developed; and, lastly, the odoriferous substance liberated chlorine from sodium chloride, and iodine from potassium iodide. Loew also found that the solution obtained after rubbing up the mineral with dilute caustic potassa, decolorized indigo solution instantly, like hypochlorite solution. To test the question more thoroughly, Loew rubbed up a quantity of the mineral, in small portions at a time, with diluted ammonia, using the filtrate and wash-water for the successive treatments. The liquid obtained after the last operation was then treated with sodium carbonate, evaporated, and to the residium (placed in a platinum dish) he added sulphuric acid. This was covered with a glass plate and kept for some time at a temperature of 40° to 50° C. (104° to 122° Fah.) On examination, the glass was then found to be decidedly corroded, thus demonstrating apparently that the substance extracted from the mineral by treatment with weak ammonia, was fluorine. Loew thinks that the peculiar fluoride which yields the free fluorine, is cerium fluoride, which is known to exist in this fluorspar. This he thinks decomposes at elevated temperatures into cerous fluoride and free fluorine.

An Improved Copying Process.—Dr J. M. Eder describes in the *Photographic News* an improved process of cyanotype printing for copying drawings, designs, tracings and the like, which is said to give excellent results. We give below the essential parts of the description. Thirty volumes of a solution of gum arabic (5 parts of water to 1 part of gum) are mixed with 8 volumes of an aqueous solution of citrate of iron and ammonia (water 2, salt 1), and to this is added 5 volumes of an aqueous solution of perchloride of iron (water 2, iron 1). This mixture rapidly thickens, and should therefore be applied with a brush quickly after preparing it, to well sized paper. The paper is dried in the dark, and then exposed to the light under the tracing or drawing to be copied. A few minutes exposure to good light is sufficient, and the print should then be developed by brushing over the surface with an aqueous solution of the ferro-cyanide of potassium. The picture appears almost instantly in dark blue. As soon as it appears distinct in all its details, it is quickly rinsed in water, then immersed in a bath of very dilute hydrochloric acid, which strengthens the image, whitens the ground, and removes the gum-iron film. The washing of the print now in water completes the process.

A simple and satisfactory printing process for copying tracings, etc., is often very desirable to architects, machinists, engineers and others, and the one here described would appear to meet the case very satisfactorily. The whole operation, including the preparation of the paper, is said not to take up more than an hour or two in fair weather. The older blue printing processes were unsatisfactory, as the ground was invariably left more or less blue by the running of the color. The use of gum in the present process avoids this objection.

Influence of Magnetism on the Electro-Deposition of Metals.—Prof. Ira Remsen, of the John Hopkins University of Baltimore, has lately made some curious and instructive experiments, to determine whether the chemical behavior of a metal was in any way influenced by magnetic action. The results which he obtained were very interesting.

Very striking effects were obtained by bringing a thin, shallow iron vessel, containing copper sulphate in solution, over the poles of a permanent magnet. Out of the magnetic field, the solution would deposit copper uniformly over the surface of the vessel; but in the field, the lines marking the poles were sharply defined as depressions in the deposit. With an electromagnet the effects were still more noticeable. In the limited space marking the outline of the poles there was no deposit of copper; within this the deposit was fairly uniform, but outside the copper was deposited in irregular ridges running at right angles to the lines of force, and apparently coincident with the lines marking the equi-potential surfaces. When the power of the electro-magnet was increased, the effects above noted were intensified and the area affected was broadened. These experiments open up a novel field of inquiry, and may in time result in important practical applications.

Another Application of Electricity as a Motive Power is reported as having lately been made in Paris, where the Faure system, in addition to its trial on the Seine for boat propulsion (elsewhere mentioned), has been experimented with as the propelling agent of an omnibus in the courtyard of the great omnibus company of that city. The report that has come to us, states that nothing was visibly changed about the vehicle. The apparatus was placed therein, and worked noiselessly, and without occasioning the least shock in starting though the road was in bad condition and on a declivity. The trials, both in ascending and descending, are said to have been equally satisfactory. The company controlling the Faure system are said to have secured permission to run carriages, etc., in a section of the city, and will soon be in operation. The company anticipate that they will be able to show that their system of electro-traction will realize at least 20 per cent saving, and that it can be operated in the crowded streets of the city without the least danger.

The Artificial Production of Nitric Acid and nitrates by direct union of nitrogen and oxygen in the presence of watery vapor, through the agency of the electric spark, has long been known to be possible. The late improvements in electro-magnetic machines has attracted attention to this method of producing nitric acid and nitrates on a commercial scale. A Belgian journal asserts that such a process is actually in use, though with what success we are not informed. An electro-magnetic machine is made to discharge a continuous stream of sparks through a series of closed vessels, through which a current of air is passing. Red nitrous fumes are produced, which are carried with the air current to a condensing tower, in which caustic potassa solution is descending. The result is a moderately strong solution of saltpeter. The process is very interesting, but its economy, in a commercial sense, is very questionable.

The Electric Light in Collieries.—Successful experiments have been made in England with the electric light in collieries. The Swan lamp was employed, in which the light proceeds from the incandescence of a fine fiber of carbon, the combustion of which is prevented by its being enclosed in an exhausted glass bulb. These were again enclosed in lanterns, so constructed as to render it impossible that the fracture of the lamp within could cause an explosion, inasmuch as the air inside the lantern would suffice for the instantaneous combustion of the carbon filaments before the flame could be communicated to the external air. The new light was found to be admirably suited for the requirements of the workers, since it not only gave a light many times as intense as the lights it replaced, but it was equally brilliant in whatever position it was placed, and required absolutely no attention.

A Simple Method of Obtaining a Relief Plate for use in the printing press, and which may be found serviceable for producing electrotypes or stereotypes of letters, signatures, written matter generally, or of drawings, sketches and designs not too elaborate, is the following, which is a very much simplified photo-engraving process: Coat a smooth surface of glass or metal with a smooth, thin layer of gelatine, and let it dry. Then write or draw upon it with an ink containing chrome-alum, allow it to dry exposed to light, and immerse the plate in water. Those parts of the surface which have not been written upon, will swell up and form a relief plate, while those parts which have been written upon with the chrome ink have become insoluble in water after exposure to light. The relief may be transferred to plaster of Paris, and from this may be made a plate in type metal.

Electrical Indicator.—By means of an electric indicator, recently invented abroad, the water level in steam boilers may be ascertained at any distance from the latter. This useful apparatus consists of an indicating tablet, constructed in such a manner that it may be placed in any part of the establishment, and connected with the electric indicator, which is fixed at the top of a vertical tube above the boiler. Wires and platinum plates are so arranged that when the water in the boiler sinks to a certain point, an electric current is established which rings a signal, while at the same time the sign "low water" appears on the indicating tablet, thus conveniently insuring against danger.

Expansive Force of Water in Freezing.—Mr. Ed. Hagenbach experimented during the past severe winter upon the bursting force exerted in the expansion of water when freezing. Two interesting experiments were made with cast-iron hand grenades. The outer diameter was 15 centimetres (5.9 inches), and the inner diameter 12.8 centimetres (5.4 inches). The shells were filled with water, closed with a screwed iron plug, and exposed to the cold. Both shells were broken, and a curved thread of ice was projected, by means of an ice column, from the upper surface. One of the plugs was evidently thrown out with great violence, and to such a distance that it could not be found. The curvature in that case was bent upward.

The Edison Electric Light.—It is announced that by the first of October, the electric light company of which Edison is the moving spirit, will be ready to furnish electric motive power and electric lights in a large section of the lower part of this city. The company is also canvassing other sections with a view to ascertaining how much power will be required to furnish motive power and light for the entire lower part of the city, and it is expected that they will be ready to supply both to all that portion of New York lying below Chambers street by the first of January.

An Improved System of Glass Roofing.

We described in our issue of last May, the details of an improved method of constructing glass roofing, devised by Mr. Arthur E. Rendle, of No. 7 Warren street, this city, and present with this brief notice two tasteful and attractive views showing the adaptability of the system in the construction of conservatories, plant houses, and the like. It will be remembered that by Mr. Rendle's method of construction, the glass is held in place by means of bent metallic plates, permitting the glass to be easily placed in position and securely held when in place. The iron and wood work are completely covered by the metal and glass when the roof is finished. The glass has plenty of play in the metal grooves, and is thus protected against breakage by expansion and contraction by reason of changes of temperature. In addition to the foregoing advantages,

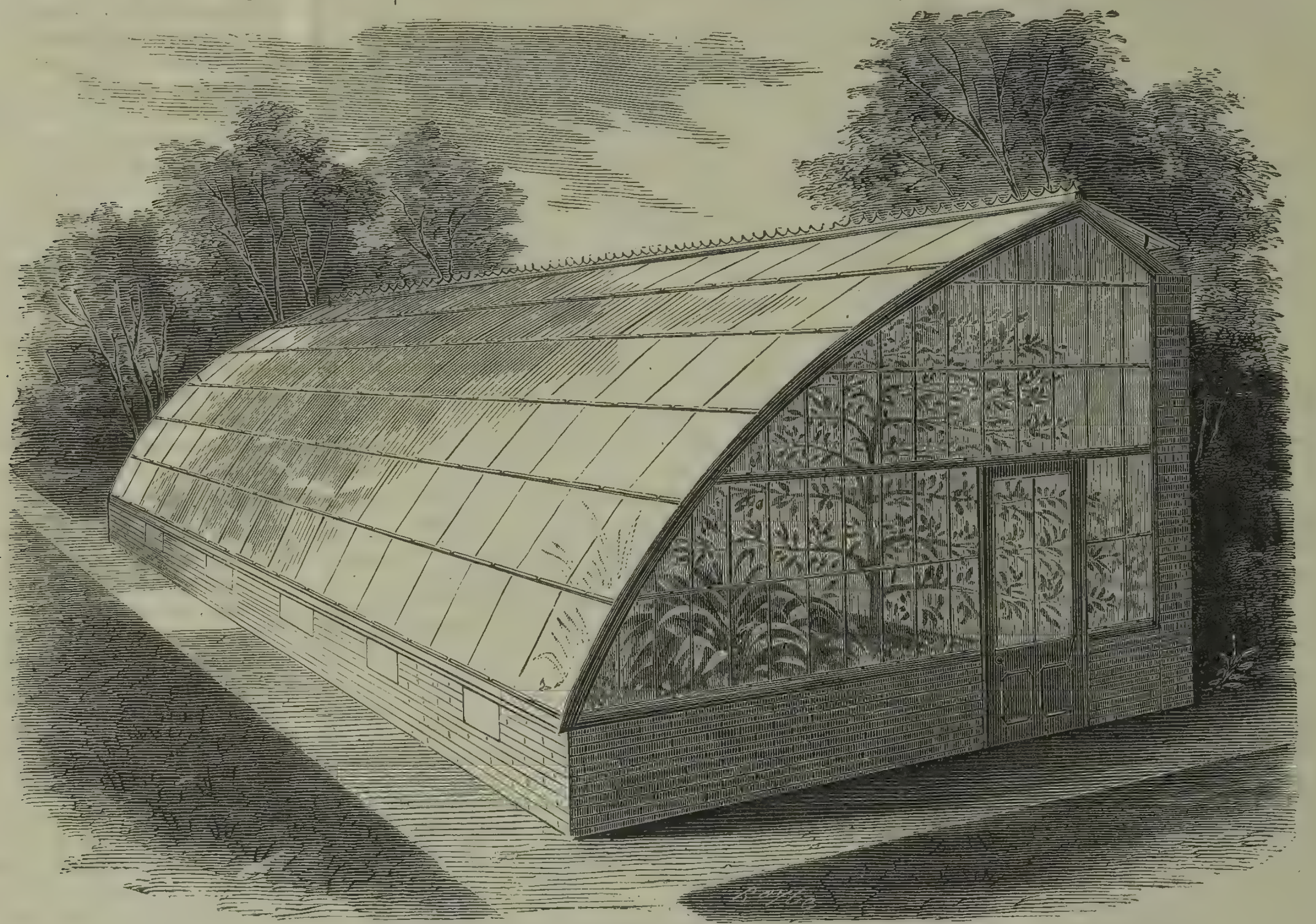


Fig. 1.—CURVILINEAR "HALF-SPAN," ILLUSTRATING RENDLE'S SYSTEM OF GLASS ROOFING.

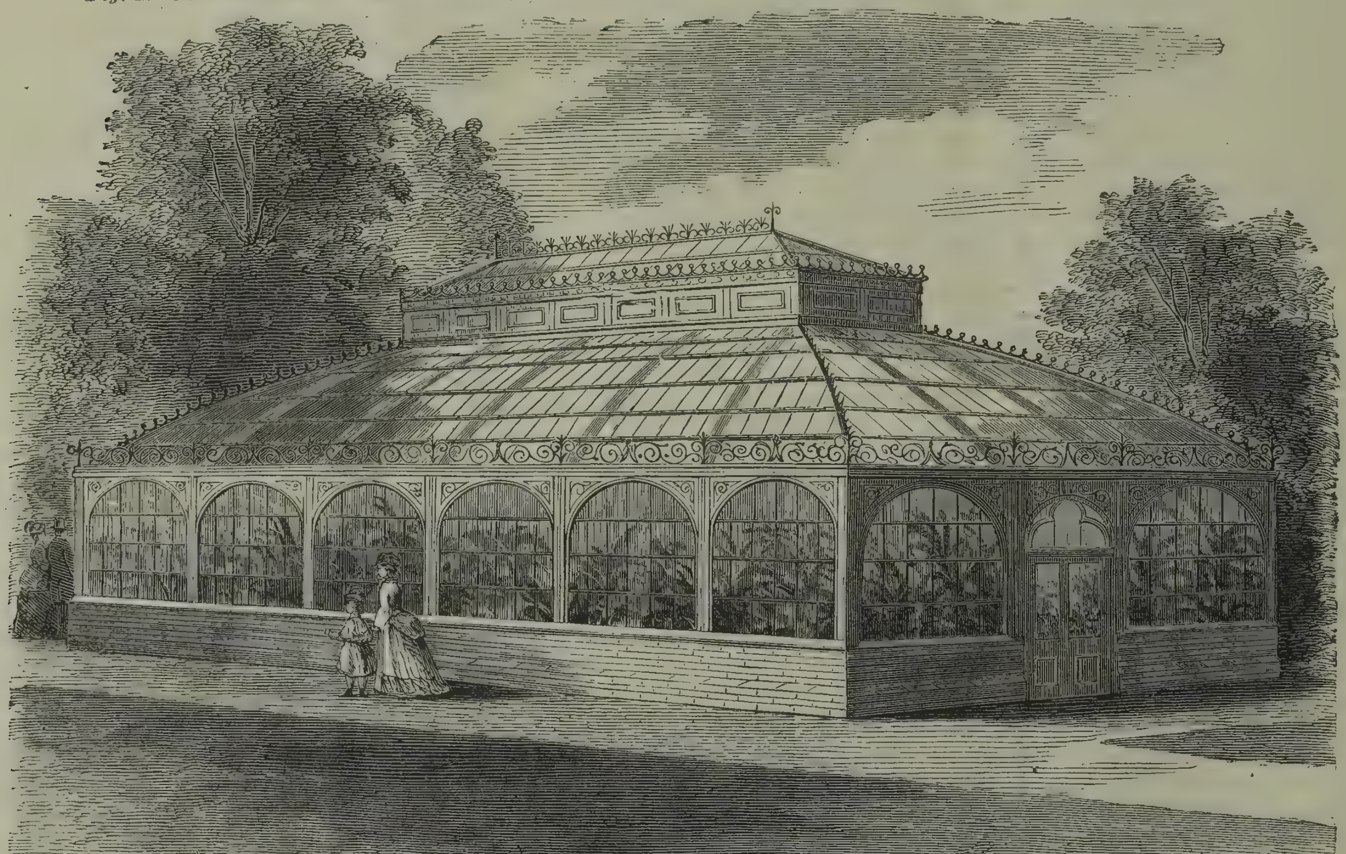


Fig. 2.—SPAN-ROOF CIRCULAR CONSERVATORY, ILLUSTRATING RENDLE'S SYSTEM OF GLASS ROOFING.

Mr. Rendle's system renders the use of putty or cement, to make the joints water-tight, unnecessary, as all moisture, whether from the outside or inside, is carried off in passages in the metallic supports, provided for the purpose. The construction is claimed, likewise, to combine great strength with lightness, and very moderate first cost.

With these references to the characteristics of Mr. Rendle's system of glass roofing, which our readers will find more fully described in the issue of this journal above referred to, we invite attention to the artistic specimens of its application to conservatories, plant houses and similar structures which are represented in the accompanying engravings.

Fig. 1 represents a curvilinear half-span orchard house and plant house, and Fig. 2, a handsome span-roof circular conservatory, plant house, or orchard house. In the Rendle system the use of expensive curved or bent glass is not required, the ordinary straight sheet glass being used. The economy of this system for circular or curvilinear structures over the old-fashioned method of putty glazing, is claimed to be considerable, not only in first cost, but very material likewise in the matter of saving in repairs.

The Rendle system, as noticed in our earlier article, has been very extensively adopted in England and elsewhere in Europe, where it has become very popular. It has lately been brought to the attention of the American public, and its merits are rapidly coming to be recognized. It is adapted for all situations where glass roofing is commonly employed, namely, for railway stations, exhibition buildings, winter gardens, markets, factories, storehouses, skylights, studios, conservatories, plant houses, etc.

A Cooling Apparatus.

An apparatus designed for lowering the temperature of apartments of dwelling houses, and especially of the sick chamber, was lately put in operation at the office of the National Gas Company, at Norristown, Pa., and proved to be very efficient. The apparatus was devised by Prof. Lowe, whose name is well known to most of our readers as the inventor of important improvements in connection with the manufacture of water gas.

The apparatus at the company's office consists of a tin tube something over a foot in diameter, which opens into the outer air on the south side of the building. Thence it runs into the basement, where it is conveyed into a sort of box containing and wholly enclosing a fan, which is rotated by a small engine. From the fan the pipe is conducted into a large wooden chest containing ice, and from the chest it is carried to a room on the first floor of a capacity of nearly 9,000 cubic feet. By the motion of the fan the current is drawn in from the outer air, and driven through the ice chest to the room above. An entrance to the latter is effected by the simple process of passing the end of the pipe through a perforated board placed under the sash of a window.

An experimental trial of this apparatus was made a few days ago, for the purpose of testing its efficiency. The temperature of the air of the apartment at the commencement of the trial was 83° Fah. An hour or so later, a thermometer placed outside the building indicated 90° Fah. in the shade, while another in the center of the apartment recorded 68°. In four minutes the mercury had fallen to 77°; in eight minutes it reached 75°, and the hygrometer showed that the air, which at the beginning of the experiment had contained 8 grains of moisture to the cubic foot, now contained only 4½. As it grew colder it became dryer.

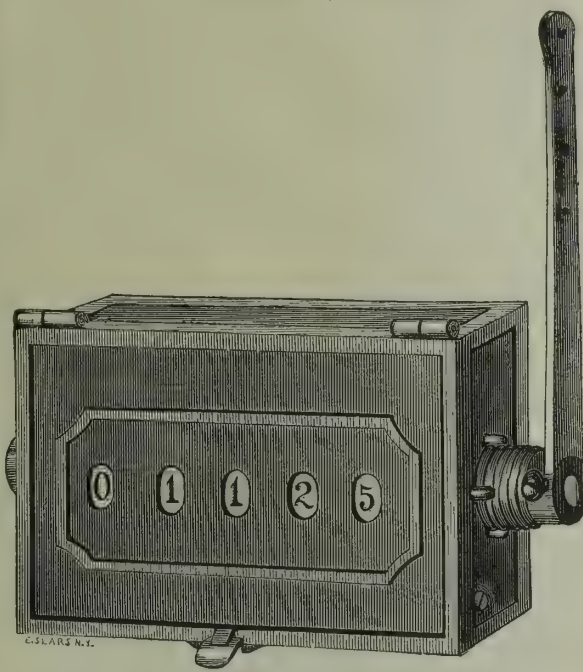
The apparatus furnishes 80,000 cubic feet per hour, and makes no perceptible noise in the running. It is so arranged that ventilation can go on without passing the air over the ice, whenever the natural temperature is found sufficiently cool; or so that a part of the air can be cooled, and on its way in, mix with the natural atmosphere, whereby exactly the degree of temperature desired may be maintained without stopping the machine. It is controlled by the simple pulling of a cord by an attendant in the room.

A compact portable apparatus containing its own power, has been devised by Prof. Lowe, which can be attached at a few hours' notice to any building, and used in cooling and ventilating either the entire building or any single room.

An Ingenious Counter.

The accompanying cut represents the external appearance of a simple and ingenious counting device, intended to be attached to machines of any kind to indicate the number of movements they make. The inventor is Mr. J. T. Hawkins, a well-known mechanical engineer of this city. The mechanism is a system of connected gear wheels actuated by the lever shown on the right of the cut, and which in turn derives its motion from the machine whose movements are to be recorded.

The apparatus is claimed to possess a number of advantageous features, chief among which are the following: It has large wearing surfaces upon every moving part, and its initial and secondary pawls are hardened so as to compensate for the large number of motions made by them; it will, therefore, wear indefinitely. It has no springs that are deflected to within one-100th of their limit of elasticity. There are no movements in it but those of the simplest mechanical kind, and it is therefore not liable to get out of order. Its movements are all positive, it can therefore never fail to indicate correctly, when properly connected. It is entirely self-contained, and may be attached to any machine by simply inserting a couple of screws, and connecting the actuating lever to any moving part of the machine by a wire, chain or cord, or anything that will impart motion to it in one direction only. The actuating lever may be secured in four different positions, thus accommodating itself to any situation on a machine that may be best suited for observation or means of connection. The range of motion of the actuating lever, in order to count correctly, is very large, obviating the necessity of close calculation or nice adjustment in attaching it. It may be instantly set to zero, or at any desired number, from any point or number. Every part is made of the best material and workmanship, and is interchangeable, even to the smallest screw.



Novel Counting Device.

These counters will indicate from zero to 100,000, and always exhibit the correct number in large clear figures, nearly as close together as the same sized figures would be written or printed. They occupy very little space (3½ by 4 inches), and they are asserted to be able to stand the roughest usage and the highest speeds without failure to indicate correctly. These counters, while useful upon all machines where a record of movements is desired, are obviously specially useful upon printing presses, for which they are much used.

Natural Gas for Puddling.

A correspondent writing to the *Titusville Herald*, expresses his surprise that so much natural gas with which the vicinity of that city is abundantly supplied, is allowed to go to waste, and wonders why the proprietors of the large iron works there do not utilize it in their works. He adds that in Kittanning, Pa., natural gas is successfully used by the Kittanning Iron Co. According to his statement, "the gas is brought from a well some three miles distant, in 4-inch casing, and at the mill is distributed amongst eighteen boiling furnaces. The furnaces are the same as those in which coal is used. The gas enters the rear of the furnace in three small pipes, shaped at the end like a nozzle. There being quite a pressure, the gas enters with considerable force, and by means of dampers to regulate the draft an intense and uniform heat is obtained. After a heat, the furnace is cooled and prepared for the next heat, in the same manner as with coal. When the metal is in place the gas is turned on, and the operation of puddling is the same, with the exception that it is somewhat slower. The puddlers like the gas very much, as it reduces their labor to some extent, and they say they can make better weight than with coal. The furnaces being free from sulphur, a better quality of iron is produced, and it brings a slightly advanced price in the market. These furnaces have been running all the time for some months past, and have used nothing but gas for fuel, which has proved satisfactory in every respect, is found to be much cheaper than coal, and has demonstrated the fact that this vast amount of natural gas, now going to waste, might be used in all our iron manufactories."

In thinking of this subject, we have frequently felt some of the surprise expressed by this correspondent, that the abundant supplies of natural gas with which the oil-producing regions of Pennsylvania and adjoining States are favored, were not more generally utilized, and especially for metallurgical purposes. Some years ago, we remember, natural gas was brought into Pittsburgh (or one of its suburbs), from a distance of seventeen miles, for supplying fuel to a number of iron and steel works, and has possibly been steadily in use ever since, though we have heard little or nothing concerning the experiment since its first introduction.

In many of the favored localities where natural gas abounds, it is used for lighting and heating towns, or for manufacturing lampblack. There seems to be no valid reason why this natural fuel should not be utilized on a great scale.

It is by this time pretty well established that the supply from the natural reservoirs remains constant for years without showing signs of diminution. It can be carried for miles from the source of supply by pipe lines, and distributed at pleasure with very little loss of pressure. As a fuel, it equals coal in heating power, and surpasses it in purity, convenience and cleanliness; and in many localities where it is now practically neglected, we are satisfied that its use would show a very decided saving over that of coal.

THE CAPACITY OF THE STEEL WORKS OF THE WORLD is estimated at about 3,000,000 tons a year. The Bessemer works in England contribute about 800,000 tons; the United States 750,000 tons more; Germany about 500,000; France about 275,000; Belgium, 150,000; Austria, 250,000; and Russia and Sweden about 150,000 tons.

Latest Market Report of Building Materials.

NEW YORK PRICES.

ARTICLES MARKED WITH A STAR (*) ARE QUOTED IN GOLD.

LUMBER.

Pine, very choice and extra dry, per M.	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	21 00 a 22 50
Pine, common box	18 00 a 20 00
Pine, common box, ⅝	16 00 a 18 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	30 a 32
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	23 a 25
Pine, strip boards, merchantable	17 a 19
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	25 a 27
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch,	43 a — 44
Spruce wall strips	14 a — 16
Spruce timber, per M.	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	48 00 a 52 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 50 00
Black walnut, good to choice	110 00 a 120 00
Black walnut, ⅝-inch	80 00 a 90 00
Black walnut, selected and seasoned	150 00 a 175 00
Black walnut counters, per ft	20 a 25
Cherry, wide, per M.	90 00 a 110 00
Cherry, ordin ary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	35 00 a 40 00
White wood, ⅝ panels	45 00 a 50 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 25 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.		Afloat.
Pale per M.	4 00	a	4 50
Up Rivers	7 00	a	7 75
Jersey	7 00	a	7 50
Haverstraw Bay	7 50	a	7 62½
" " choice	7 75	a	8 00
Favorite Brands	8 25	a	9 00
Hollow Fire-Clay Brick	9 00	a	9 25

FRONTS.

Croton—Brown per M.	11 00 a 12 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	30 00 a — —
Trenton	28 00 a 30 00
Baltimore	40 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	24 00 a 24 25
" Glengarnock	22 50 a 23 00
" Eglinton	21 00 a 21 50
" American, No. 1	24 00 a 25 00
" American, No. 2	22 00 a 23 00
" American, forge	21 00 a 21 50

LEAD—PER 100 POUNDS.

*German	— — a — —
*English, common	— — a — —
*Spanish	5 75 a — —
*Foreign, refined	— — a — —
*Bar	6 50 a — —
*Sheet	7 50 a — —
*Pipe	— — a — —
*Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1½ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

*I. C. charcoal, 10x14, per box	6 25 a 6 50
*I. C. coke, 10x14	5 25 a 6 00
*I. X. charcoal, 10x14	8 25 a 8 37
*I. C. charcoal, 14x20	6 25 a 6 50
*I. X. charcoal, 14x20	8 25 a 8 37
*I. C. coke, 14x20	5 25 a 6 00
*I. C. coke, terne, 14x20	5 00 a 5 25
*I. C. charcoal, terne, 14x20	5 25 a 5 50

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb.	— 7 a — 7¼
Sheet, (open)	— 7½ a — 8

SOLDERS.

No. 1	— 12 a — 13
No. 2	— 11 a — 11½

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a - —
do do No. 1, blue, in rough	- 85 a - 95
Bedford Stone	1 25 a - —
Berlin Freestone, in rough	- 75 a 1 00
Berea Freestone, in rough	- 75 a - 00
Brown Stone, Portland, Conn	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a - —
do Mary Point Brown Stone	1 00 a - —
do do Olive Stone	1 00 a - —
Brown Stone, Belleville, N. J	1 00 a 1 35
Granite, rough	- 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a - —

PAINTS.

Carmine, American, per lb. gold	5 00 a 5 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton gold	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6¾ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil gold	— 9 a — 10
Litharge	— 6¾ a — 7
Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
Orange Mineral, English gold	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
Vermilion, Chinese, per lb	— 85 a — 90
Vermilion, Trieste	— 70 a — 75
Vermilion, quicksilver, bags gold	— 50 a — 52½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
Zinc, white French, dry, (Red Seal,) gold	— 7 a — 8
Zinc, white French, in oil gold	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 30 a — —

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — —
Goat, " "	— 21 a — —

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent. ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	1 25 a — —
" finishing	1 50 a — —
Rockland, common, cargo rate	1 50 a — —
" finishing	1 75 a — —
Ground	1 25 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 20
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	2 00 a 2 50
Masons, do	4 00 a 4 50
Plasterers, do	4 00 a 4 50
Carpenters, do	4 00 a 4 25
Plumbers, do	4 00 a 4 50
Painters, do	3 00 a 3 50
Stone-Setters, do	3 00 a 3 50

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	24 a —
Up to 3.1 wide	26 a —
Up to 3.4 wide	28 a —

WINDOW FRAMES.

Up to 3.4 x 7.2, put together	2 30 a — —

REVIEW OF THE MARKETS.—In the lumber market during the past month buyers in some cases have claimed a trifling advantage, and in others there has been a turn in favor of the seller; but, taken altogether, the balance was a fair one, and the general market has been in excellent shape. A large amount of lumber must yet be handled to meet established consumptive wants, to say nothing of the new calls likely to arise, besides which there must also be secured an accumulation for winter use by manufacturers and for distribution from yard. Indeed, a steady demand up to the close of navigation seems to be assured, with every probability that current values are about as low as merchantable goods will have to be offered, and fair chances exist for an advance in a great many cases.

In the lime market a great advance has taken place in prices, bringing our quotations up to $1.50 per barrel on common, and $1.75 on Rockland finishing, with State in proportion. These extreme figures cause much comment, and naturally some complaint, but with dealers absolutely in want of stock, and very few lots arriving, they had to compete sharply for whatever turned up, and hence the advantage to the selling interest.

In the brick market the supplies of common hards have exceeded the demand, and the surplus was such as to lead to another considerable weakening on values, with the tone of the market for a time quite heavy. The actual consumption of brick has not fallen off to any remarkable extent—indeed, on some of the large jobs it is just about commencing, but the quantity of stock seeking to supply the consumption has certainly been greater than required, and it was simply a question either of carrying or putting the cost down to attract buyers.

In the lath market the tone has been strong during the month, the demand proving active enough to take all the stock coming in and calls for more, with prices still on the upward turn.

In the cement market domestic brands have been in good demand, with a firm tone reported, and, according to the spring agreement between the manufacturers, the rate on the first of the present month was placed at $1.30 per barrel. Foreign brands have not been plenty in first hands, even the ordinary grades appearing to have sold up close, and prices have been very firm at full former figures.

In the hardware market demand has been good, and continues on the increase, with new sections of the country represented by every day's arrival of buyers. The orders brought have been full, and goods have been handled evidently because they were really wanted. City consumption has been somewhat better, and promises a steady improvement. Prices generally have been firm and a little on the upward turn in many cases.

In the metal markets manufactured iron has been in good steady demand and the tone of the market well preserved, especially for jobbing parcels. Scotch pig has been held at about former figures throughout, but has been slow of sale, and the tone a little weak under less favorable accounts from abroad. American pig has been offered somewhat carefully, and holders generally have made good efforts to sustain the market. Demand has, however, proved slow and moderate, with evidences of indifference on the part of the principal buyers. Domestic pig lead has been in very good general demand and the market well sustained, with no surplus of stock offering, though apparently sufficient available for all wants. Pig tin has not been very active, but remained under control and firmly held in all cases. Tin plates have been active in small parcels at steady rates. Sheet zinc has been moderately active, without change in cost.

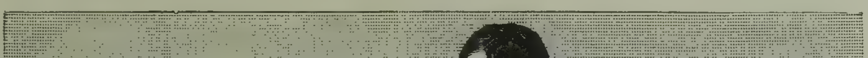
In the paint market demand has been fair, with possibly a tendency to increase.

Home Department.

A New Instrument in Electro-Therapy.

The value of electricity as a curative agent in many forms of disease has long been recognized and admitted by the medical profession. Much of the apparatus, however, that has been devised for this purpose is very elaborate, and its use involves the services of an expert skilled in its use, in order that the full benefits of the agent shall be realized. On these accounts, the employment of electricity as a curative agent has been made so expensive and troublesome, both to the physician and his patient, that it is by no means either so popular or useful as its real merits deserve. Again, the peculiar nature of the agent, and the mystery that surrounds everything relating to it, have made it a favorite with the hosts of quacks and charlatans that prey upon the credulous and ignorant; and on this account the practice of electro-therapy—as the electric curative method is technically called—has fallen into unmerited disrepute among the body of reputable physicians.

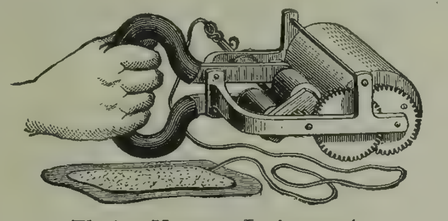
In view of the foregoing facts, the desirability and importance of an electrical instrument, simple and inexpensive, and by means of which electrical currents could be generated and applied to affected parts or members of the body by the ordinary unskilled attendant, a member of the household, or even by the invalid himself, are very evident. Such an apparatus is illustrated and described in what follows. It is an exceedingly simple instrument, highly original in design, and admirably adapted for its intended uses, which are, to combine in one instrument the procedures of kneading, rubbing, etc., with electrical treatment. In certain muscular, articular and nervous troubles, much benefit is derived from the services of a manipulator, who should be a person skilled in the practice, and whose business it is to rub, knead and pound, flex and extend the joints, etc., of the patient. This procedure is often followed by electrical treatment where the case is of such a nature as to indicate its use. To submit to both of these procedures successively, however, as may be readily imagined, involves much fatigue and discomfort to the person operated on.



Practical Application of Electro-Massage.

Having had occasion to employ these methods in certain cases, it occurred to Dr. John Butler, of this city, that the disadvantages and discomforts of the treatment would be materially lessened if it were possible to combine the two methods of procedure—*Massage* (manipulation, or friction by the hands, on the limbs and joints), with electricity; and in watching the manipulator at his work, he conceived the ingenious and original idea, that if the mechanical motion used in rubbing the patient could be made to generate an electrical current, which could be transmitted through the affected part while it was being manipulated, the requirements of the case would be met. Following out the idea just named, he succeeded in devising the instrument which is herewith illustrated and described, and which he found would not only answer its intended purpose, but would also serve equally well for a number of others.

The instrument, as will be perceived by consulting the accompanying cuts, consists of a metallic roller, covered with chamois leather or other suitable material; an electro-magnet; and a permanent magnet, set in a strong frame, which holds the apparatus together. The roller acts as one of the electrodes, and is likewise the driving portion of the apparatus, communicating its motion through connecting gearing to the electro-magnet, causing it to revolve its poles opposite to those of the permanent magnet. The rounded portion of the latter, which is flared for greater convenience, forms the handle by which the instrument is moved over the surface of the patient's body. The proportions of the gearing are such that each revolution of the roller causes the electro-magnet to make twenty-five revolutions. The current thus induced is interrupted at each revolution by a break-piece. The instrument gives a current sufficiently strong for all pur-



Electro-Massage Instrument.

poses for which it is intended to be used. To complete the circuit, a flexible metallic disk, or other suitable electrode, is connected by the binding post, the roller acting as the other electrode. Both electrodes are brought into contact with the body of the patient, and as the moistened roller is moved about with gentle or vigorous pressure, as the case may require, over the surface, the current is established and transmitted through the part over which the roller is caused to revolve.

This instrument, as will have been learned from the above description, combines at once the properties of a generator of electricity and of a kneading, rubbing or manipulating device. It is exceedingly simple, inexpensive and not liable to get out of order. Its operation, likewise, is so simple and obvious, that any person will understand how to use it after a few simple directions from the attending physician. As the current is generated by the inductive effect of the permanent magnet, the battery, with its objectionable acids or other liquids, is dispensed with, and the instrument is always ready for use when it is required. It is, moreover, very compact and portable, and may be readily carried in an overcoat pocket.

Dr. Butler, who has devised this ingenious apparatus, affirms that the results from its use have exceeded his expectations. Its employment is very convenient; it fulfills most of the requirements of the induction current in general practice, and gives greater tonic effects than can be obtained from the old procedure of using manipulation and electricity separately.

Dr. Butler gives explicit directions in a descriptive pamphlet before us, as to the particular mode and manner of applying his apparatus in special cases. By consulting the description in question, any person of ordinary intelligence will be able to use the instrument properly. Dr. Butler has used his method of electro-massage with very gratifying results in cases of such disorders as nervous exhaustion, muscular rheumatism, chronic articular rheumatism, chronic constipation, atonic dyspepsia, general debility, paralysis, neuralgia, uterine troubles and the like.

From what we have learned in the perusal of Dr. Butler's pamphlet, and from the description and character of his apparatus, we have no doubt that the medical profession is indebted to him for a substantial improvement in the practice of electro-therapy.

The manufacturers of this instrument are the Dynamo-Electric Manufacturing Co., of 907 Broadway, New York city.

Ventilation of Workshops.

A workingman writes to the *Christian Register* very sensibly concerning the connection of bad air and intemperance. He says that working in a large room in a shoe factory, with from fifty to one hundred others, the fumes of tobacco mingling with the sickening smell of leather, he found it useless to try to ventilate the room by windows. Every morning he lowered them an inch, but in half an hour all would be closed. The door had a spring which prevented its being left open a minute, and there was no way of securing fresh air. When he left his work at night, he felt so faint and lifeless that he longed for a stimulant. Many of the men went at once to the nearest saloon when the day's work was ended. The men think it is hard work that makes them feel so tired, but in reality it is breathing and rebreathing, hour after hour, air which have has been deprived of its oxygen and is loaded with poison. Of course ill health is general among the workmen, and it is not strange that the fifty liquor shops in the town are well supported. It is much to be wished that employers understood the importance of securing an abundant supply of pure air in their shops and factories. To do so would serve their own interests, as the workmen would perform their tasks with more vigor and speed. There would also be less time lost from drunkenness. If the workmen were better informed, they would insist upon ventilation.

Removing the Skin of Peaches.—The following improvement in removing the skin of peaches, which is said to be in use in certain peach-drying establishments, may be worth knowing. A crate of peaches is lowered into a vat containing hot lye, and there agitated for a few moments. It is then withdrawn, and immersed in a tank of flowing cold water, which almost instantly carries away the lye. By this operation the skin of the fruit is so separated from the pulp that it can be rubbed off by the slightest pressure of the hand. In large establishments the work of peeling the fruit

is by this process very greatly hastened. The same plan will doubtless be equally applicable to other fruits—apples, pears and the like, and housekeepers afflicted with the preserving mania may find the hint useful.

Women as Doctors.

At the recent commencement of the Women's Medical College in Philadelphia, some interesting facts were stated concerning the career of the graduates of that institution, which have a direct bearing on the success of women in this field of professional labor. The following are the more important of these statements: Of the 276 women who had graduated from the college in the past thirty years, 32 had died, 31 had given up their profession, and 151 were then practicing. Of the 151 in practice, the incomes of 24 were between $1,000 and $2,000; the incomes of 20 were between $2,000 and $3,000; of 10, between $4,000 and $5,000; of 3, between $5,000 and $15,000; of 4, between $15,000 and $20,000; and of 10, less than $1,000. The average income from practice was about $3,000. Sixty-six were members of medical societies; 51 were married after studying medicine, and 61 before; of 50 who were married, 43 reported that the practice of medicine had no unfavorable effect on their domestic life; with 6 the effect was not entirely favorable; with 1 it was unfavorable; 3 were prevented by practice from marrying, and 5 gave up practice on account of marriage.

These facts make an exceedingly favorable showing for the women doctors, and should be a convincing argument in favor of the practice of medicine by the sex. Indeed, the opposition to them has so materially lessened during the past few years, that it can hardly be said to have any existence since the majority of the medical societies have withdrawn their opposition.

The Atlanta Exhibition.

The Cotton Fair projected some time ago by a number of enterprising citizens of Atlanta, Ga., has grown upon the hands of its projectors until it has assumed the proportions of a great exhibition of textile products and manufactures, which promises, from the very widespread interest that has been manifested in the undertaking in the North as well as in the South, to be by far the most extensive and important exhibition of the kind ever held in this country. Already, it is announced, over 1,400 exhibits have been entered, and the number is said to be increasing daily. Special exhibition buildings had been erected to accommodate the display, but it was found necessary to double the space at first contemplated.

The greatest praise is due to the enterprise and energy of the projectors of this exhibition; they having left nothing undone to insure its brilliant success. The Northern and Eastern mills have been thoroughly canvassed in the interest of the exhibition, and these sections of the country will be fully represented by machinery and by manufactured products. England also promises to be well represented, two steamships loaded with machinery and products being at present on the way. The Atlanta exhibition will no doubt give a great impulse to the spread of manufacturing in the South, and the friendly rivalry and intercourse of merchants and manufacturers of the North and South will be beneficial to the whole country.

Chicago Industrial Exhibition.

The Inter-State Industrial Exposition at Chicago opened September 7th, and will close October 22d. There will be an improvement in all departments over any previous year. The machinery department will occupy a space of 240 by 600 feet, all of which will be filled without accommodating all the applicants, and constituting the largest exhibition of machinery ever made in this country except at the Philadelphia Centennial. The display will consist of all kinds, both light and heavy, including a large variety adapted to railroad uses in machine and car shops, and will be driven by 1,200 feet of shafting. The exhibitors are from all parts of the country, the Eastern States being well represented.

INTERESTING IF TRUE.—A hitherto entirely unsuspected relation between engineering science and the domestic arts has lately been brought to light, if we may credit the following curious statement in one of our exchanges: "A French engineer, after a series of experiments with a loaf of bread baked by a Vassar College girl, now announces that the project of tunneling Mount Blanc is entirely impracticable."

Miscellaneous and Advertising.

The Hartford Engineering Co., of Hartford, Conn., are to furnish a high-speed engine for the electric lights in the New York post-office. The engine is to be 12 × 21 inches, and is to run at 200 revolutions. It is to do the work now being done by a low-speed engine 16 × 30 inches, which is run at 80 revolutions.

The accumulation of soot in chimneys may be prevented by putting a quantity of salt into the mortar with which the interior courses of brick are to be laid. The philosophy of this method may be thus stated: The salt in that portion of the mortar which is exposed absorbs moisture from the atmosphere every damp day. The soot thus becoming damp falls into the fireplace.

The Women's Silk Culture Association, of Philadelphia, has issued a circular, with instructions in the growth of cocoons, for distribution in villages and rural districts, and offering premiums for the best cocoons in samples weighing not less than one pound. These prizes are of $200, $150, $100 and $50 for the best four, and are intended to encourage the industry.

The Tanite Company, of Stroudsburgh, Pa., whose emery wheels are highly esteemed here and abroad, have just been the recipients of a certificate and medal awarded to them for excellence in their special manufactures, by the judges of the Sydney International Exhibition. The exhibit of the Tanite Co.'s goods, which gained the honorable distinction above named, was made by the agents of the company in that distant quarter of the world, on their own responsibility, and was selected from the ordinary stock with which the company's agents are supplied. These facts reflect much credit on the company. They testify to the enterprise which has made a market for their products in the far-off Pacific continent, and demonstrate the uniform excellence of the company's manufactures.

Design for a Comfortable Dwelling.

On the opposite page is presented a house built in Champaign, Ill., by Prof. S. W. Robinson, formerly of Champaign, but now of the Ohio State University. It was built from plans of the professor as an amateur architect, and were the result of five years of occasional thought and study.

It is said that we often make the pleasantest room in the house the parlor, and then shut it up and live in back rooms. This is too true, and many renters would say: "I would never build such a house." But probably many of them would when they come to build, because the putting of parlor, sitting-room and hall in the front is easier said than done, especially if other rooms are left in convenient and desirable relation. The things desired in a modest house plan, are: 1st. A parlor fronting on the street. 2d. A sitting-room half or more fronting on the street, and connected to the parlor by sliding or folding doors, to throw both rooms into one for entertainments, or even family comfort. 3d. A dining-room opening from the sitting-room, as it evidently should. 4th. A sleeping and toilet room of ample size, opening off the sitting-room. 5th. A hall fronting on the street, large enough at least for a hat and coat rack, or for receiving three or four persons, or as many as are likely to come at once, the same being in communication with the parlor and sitting-room. 6th. A kitchen opening off from the dining-room, with its stove, table, pump, sink, etc., in convenient relation.

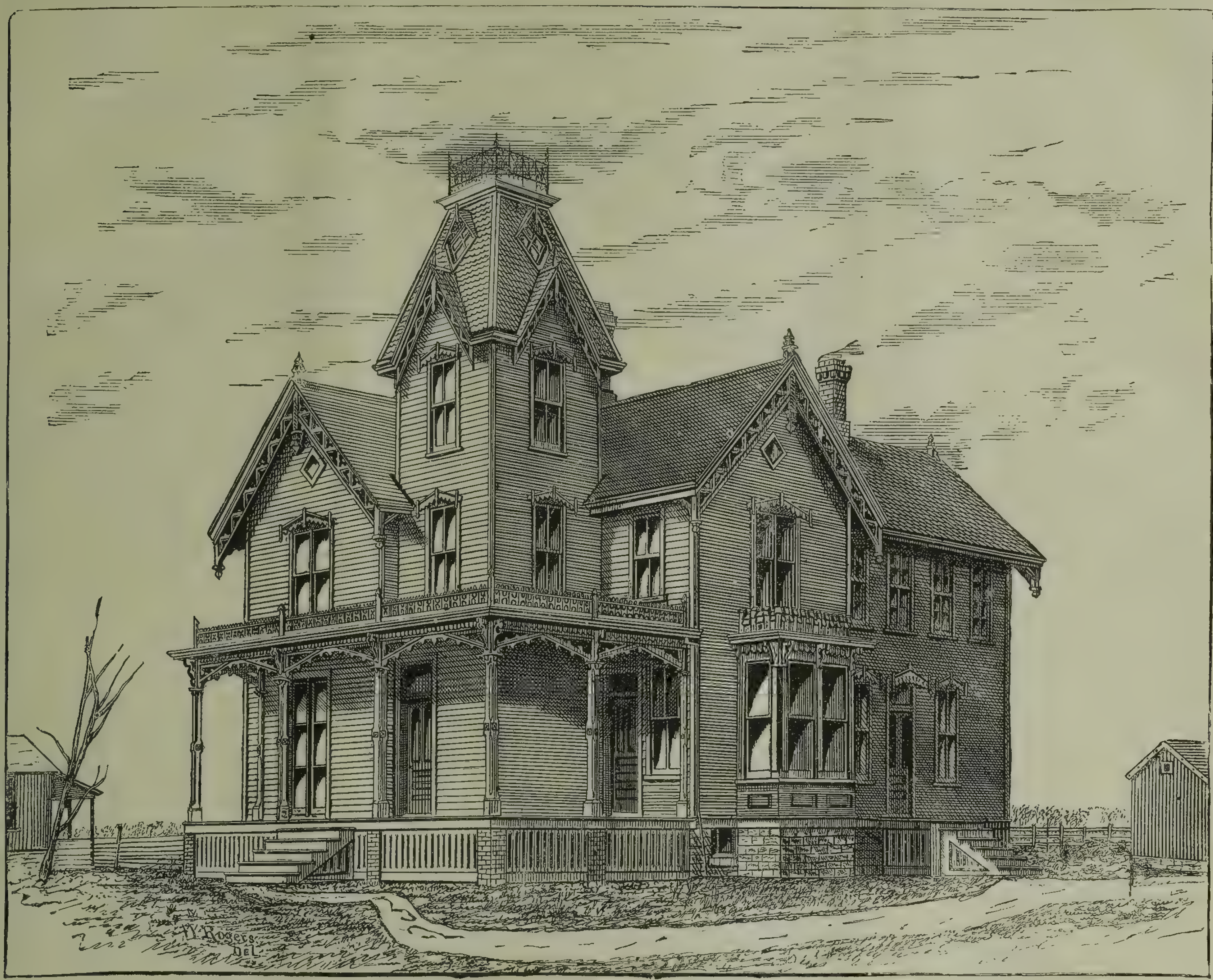
The arrangement of rooms in the second story is a comparatively easy matter. Where the house is to be heated by a hot-air furnace, still further thought will be needed in securing such a position of the smoke and air flues as to properly heat and ventilate all the rooms. Though the number of our days depends much upon this latter point, it is usually disposed of as if involving nothing but the number of hods of coal.

The hall has a winding stairway, and is located in the base of the tower, 9 feet square. This size of hall admits of its being in front, and at the same time allowing full front to the parlor, half front to the sitting-room, with a large doorway between; small stairs ascend to the second story of the tower.

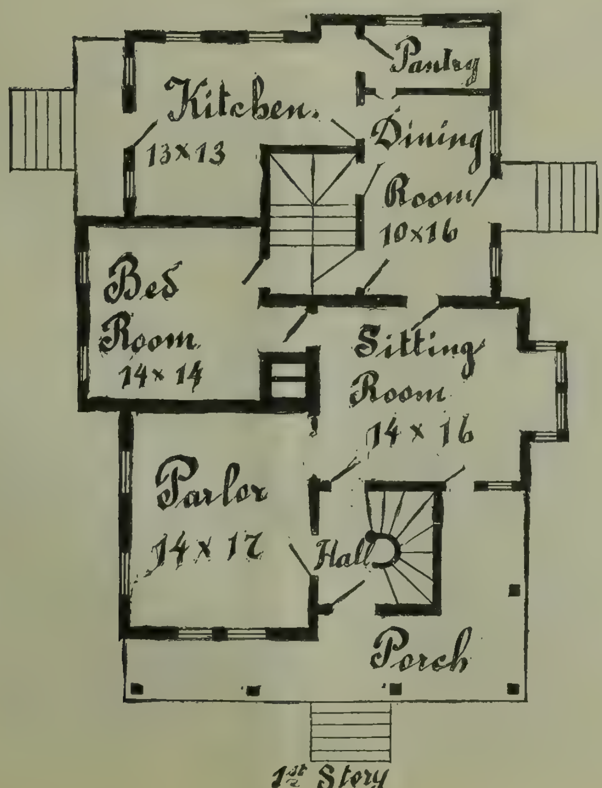
The double rectangle at the middle of the plans are the smoke and air flues, the latter being nearest to the front. Seven rooms in the house are heated with a hot-air furnace. The air enters the room near the base or through the floor, and rises. The exit is in the wall near the base in all cases, and into the air flue of the chimney. The registers have an effective opening of about a square foot, and have been found efficient. The furnace is placed in the cellar, where space is provided for a car load of coal.

The tower has another use than for ornament. In hot weather its efficiency as a ventilator is remarkable. In quiet summer nights an enjoyable air current is established through any room having an open window and an open door and passageways to the tower, the attic windows or ventilators of the tower being open. A tower is, therefore, found useful in three ways, first, in ventilation; second, as an observatory; and third, in architectural effect.

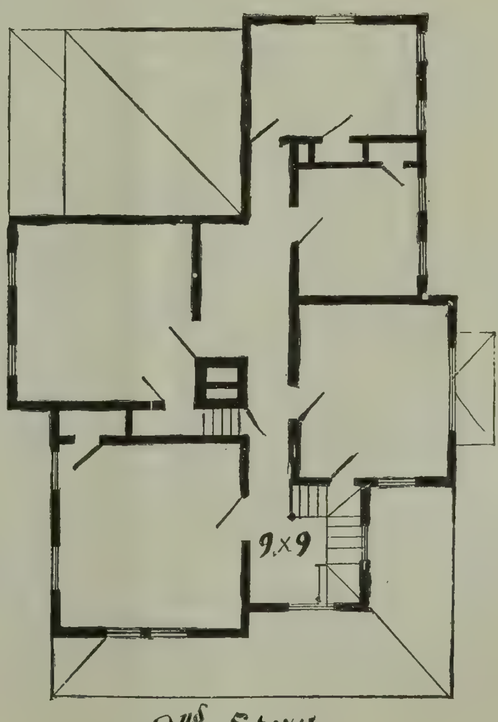
The outside is covered with ordinary siding laid on tarred paper. The ornaments are mostly cut from boards, strips being sometimes laid on, forming panel work in addition. The entire adornments of the building cost about 6 per cent of the total cost of $4,400, the latter including everything permanent, such as foundation, furnace, etc. The carpenter's contract was $3,100. All the windows, except those of the kitchen, have inside blinds, the transoms having sand-blast glass, except those of the front hall, where all lights are of cut glass.



DESIGN FOR DWELLING, COSTING $4,400.



1st Story



2nd Story

Blast Furnaces of the United States.

The condition of the blast furnaces of the United States on July 1, 1881, is given below from the usual quarterly statement published by the *Iron Age*. This statement, in view of the reports that have been current as to the very general blowing-out of furnaces, is of more than usual interest. The condition of the furnaces on the first of each quarter in this year was as follows:

Fuel Used.	Furnaces in Blast. Jan. 1.	April 1.	July 1.	Fur's out of Blast. Jan. 1.	April 1.	July 1
Charcoal......	160	139	147	112	132	125
Anthracite.....	162	159	146	76	80	90
Bituminous....	151	155	144	68	64	77
Total......	473	453	437	256	276	292

This statement shows that 36 more furnaces were out of blast on the first of July last than on the first of January. It shows, also, that more furnaces were blown out during the first quarter than during the second.

A noticeable feature of this report, is the greater average capacity of the active bituminous furnaces; 146 anthracite furnaces in blast on July 1, have a capacity of 33,313 tons a week; 144 bituminous furnaces in blast have a capacity of 48,796 tons, or nearly one-half greater.

For the last five years the relative condition of the furnaces on July 1, was as follows:

Fuel Used.	In Blast. 1877	1878	1879	1880	1881	Out of Blast. 1877	1878	1879	1880	1881
Charcoal....	87	64	81	131	147	181	202	176	136	125
Anthracite...	87	95	101	167	146	139	130	125	68	90
Bituminous..	85	89	95	115	144	123	128	107	109	77
Total....	259	248	277	413	437	443	460	408	313	292

This table shows that the anthracite furnace industry alone is in a worse condition than a year ago, 21 furnaces more being out of blast now than then, while of the bituminous furnaces 29 more are in blast than there were then, and of the charcoal furnaces 16 more are in blast than were then in operation. Altogether, there were 24 furnaces more in blast on July 1st than a year ago.

This tabulation shows that the condition of the iron trade, as represented by the number of furnaces in and out of blast, is by no means so unwholesome as has been made to appear by journals interested in "bearing" the stock market.

Automatic Track Tester.

The Pennsylvania Railroad Company, it is reported, has in regular service an automatic track tester, so delicately and ingeniously constructed that it serves to discover and automatically register faults in the track which would not be appreciable to the eye, the record, at the same time, indicating the precise locality of the fault while the car containing the apparatus is passing over the track at the rate of from 15 to 20 miles per hour.

The following abstract from one of the railway journals will serve to indicate the delicacy and capacity of this apparatus: It has the external appearance of a baggage car, but inside is fitted up with a self-registering apparatus, electrical clocks, etc. A bad joint between the rails registers itself by the jolt it causes to the delicately hung car. Errors of level in the track are recorded by pencils on ruled paper, and so nicely arranged that variations of an eighth of an inch are made manifest. If the gauge is too narrow, or the rails have spread, the fact is noted by another apparatus. An ingenious time and distance register enables the observer to locate the imperfections recorded.

Underground Telegraph Lines.

The extensive system of underground telegraph lines projected some years ago by the German government, is rapidly approaching completion. The work was commenced about five and a half years ago, and after the success of the first line between Berlin and Halle, a distance of about 110 miles, it has been steadily pushed forward. At present there have been laid 3,400 miles of cables, representing 23,255 miles of wires, the whole forming an extensive net-work of underground lines connecting all the chief cities, towns and fortresses of the empire with each other, and with the capital city, Berlin. The number of cities and towns thus connected by the underground system is said to be 221. All the lines thus far laid have proved highly satisfactory in operation. Most of the cables contain 7 wires, and a few only 4. The entire cost of this extensive system of underground land lines has been about $7,000,000.

THE STOW FLEXIBLE SHAFT has been successfully applied to a tower clock in Philadelphia. Owing to lack of space, it was found inconvenient to make the ordinary connections with the dials, and flexible shafting was employed with very satisfactory results. The flexible shafting economizes room, and avoids the obscuration of the dials by boxing, which would be necessary with the plan usually adopted in such cases. This case is said to be the first application of flexible shafting to horology, and as such is a novelty worthy of mention.

New Publications.

Microscopic Examination of Samples of Commercial Arsenic, and the Practical Results to which it Leads. By Edward S. Dana, Ph.D. Jersey City, N. J.: F. D. Linn & Co. Price, 50 cents.

The above work, which forms a pamphlet of 36 pages, illustrated with a number of plates representing the appearance of different samples of arsenic beneath the microscope, contains the record of an extended series of experiments to determine the possibility of distinguishing and identifying different samples of commercial arsenic made by different processes, by means of the microscope. The incentive to the investigations herein contained was given by a recent trial for murder by poisoning with arsenic, which attracted widespread public interest, and during which the question of the possibility of distinguishing between samples of arsenic from different sources became one of the important features of the case. This question has never before been raised in connection with the numerous trials for arsenic poisoning, and the interesting character of the results obtained by Prof. Dana will give to his investigations a standard position in the chemico-legal history of future cases of a similar kind.

In the course of this investigation, the author visited the noted arsenic manufactories of England, for the purpose of personally acquainting himself with the mode of producing and preparing commercial arsenic. The knowledge gleaned in this way proved of great importance in enabling him to understand and explain the differences between different samples of arsenic which the microscope revealed. The result of the investigation was to establish the fact that the microscope afforded an infallible means of distinguishing between commercial arsenic made by different processes. These results are very properly esteemed by scientific men to be of the greatest value, and they have opened an entirely new line of inquiry and examination in judicial trials of cases where arsenical poisoning is charged.

Geological Survey of Alabama. Report of Progress for 1879 and 1880. By Eugene A. Smith, Ph.D., State Geologist. Montgomery, Ala.: State Print. 1881.

The present report continues the description of the coal measures of the Warrior field, and is substantially a reproduction of the geological details obtained in a survey of the Warrior River from Tuscaloosa to the Sipsey Fork, under the auspices of the War Department. The coal deposits of the Warrior field are destined to play a most important part in the development of the industries of Alabama, and the successive reports of the State geologist have contributed much valuable information concerning them. The present work likewise contains a report by Henry McCalley on the counties lying north of the Tennessee River. It contains also an outline map of the State and a map of the Black Warrior River from Tuscaloosa to the Sipsey Fork, showing the location of all outcroppings of coal where they have been observed and measured.

United States Geological Exploration of the Fortieth Parallel. Clarence King, Geologist-in-Charge.
Odontornithes; A Monograph on the Extinct Toothed Birds of North America; with 34 plates and 40 wood-cuts. By Othniel Charles Marsh, Professor of Palæontology in Yale College, etc. Washington: Government Print. 1880.

This volume, lately issued from the government printing office, is an exhaustive monograph on the remarkable toothed birds found in the cretaceous deposits of western Kansas. The material upon the study of which this work is based, was in large part collected by Prof. Marsh in person, and the remainder was collected by expeditions sent out by him for the purpose. These expeditions resulted in the discovery of the remains of no less than 150 individuals, representing 9 genera and 20 species of these fossil birds. These remains were made the subject of careful study by Prof. Marsh during the past ten years, and the fruits of his labors upon this highly interesting type of vertebrates are contained in the magnificent volume now before us. The work of Prof. Marsh will be welcomed by palæontologists the world over, as one of the most valuable contributions to this science that has been made in recent times, and, dealing as it does with a unique type of fossil remains, it will be received with special interest.

The work is admirably printed on heavy tinted paper, and the execution of the numerous plates leaves nothing to be desired.

Leffel's Construction of Mill-Dams, and Bookwalter's Millwright and Mechanic. Illustrated by numerous full-page plates. Springfield, O.: Jas. Leffel & Co. 1881. Price, 50 cents.

Some years ago, the publishers of the work here named, issued a large octavo volume with the title, "The Construction of Mill-Dams," a work of very practical and useful character. It was intended for the use of owners and users of water-power; and while very full and accurate in its descriptions, was written as plainly as possible, as best suiting the requirements of a class of which a large proportion are unfamiliar with the technical terms and mathematical reasoning employed in more elaborate works on the subject. The work spoken of, as the result proved, was well received, a large edition being very soon exhausted.

The present work is a revised edition of the one above referred to, and is issued in a cheaper and more convenient form than its predecessor. With this the publishers have also incorporated another useful work, entitled "Bookwalter's Millwright and Mechanic," which contains a large number of rules and tables pertaining to hydraulics, milling, and other branches of the mechanic arts; together with an array of useful facts, figures, methods, etc., of use to mill owners and operators and mechanics of every class. The present edition makes a neat duodecimo of 283 pages, in flexible covers. It is well printed, and fully illustrated with numerous creditably executed engravings.

Are Subterranean Telegraph Lines Practical? By Stephen Chester, C.E.

In this pamphlet of ten pages, Mr. Chester discusses the question of the practicability of underground telegraphy in a very intelligent manner, taking up the technical objections that have been advanced against the underground system, and answering them. We heartily agree with the author's statement of the objections to the overhead lines, and with his general conclusions respecting the practicability of underground telegraphy. Referring to the nuisance of poles and wires in our cities, he remarks that they not only disfigure our streets and greatly impede free transit, but they threaten in the near future to become an insupportable evil demanding some heroic remedy. After fully discussing the objections to the underground system, he concludes that it is quite feasible to construct systems of underground conductors that will answer the purposes of the telegraph and telephone as completely as the overhead lines that now disfigure our streets and expose our persons and property to constant risk. Such lines would be practically indestructible, and could be so constructed as to be readily accessible for repair or examination, without annoyance or interruption to traffic. The author adds, finally, that there is no valid reason that can be assigned why we should longer submit to the dangers and inconveniences to which we are subjected by the daily increasing accumulation of telegraph poles and wires.

Mills' Directory of Boiler Owners and Steam Users, for New York and New Jersey. 1881.

This directory has been carefully prepared by the J. N. Mills Publishing Co., of this city, for the use of manufacturers and dealers who do business with the users of steam. To this class of our business community the value of a reliable directory covering a territory so numerously represented in steam users as the States of New York and New Jersey, is obvious; and the publishers' statement that "the advantages it presents for canvassing or reference, or for sending circulars and price-lists, is worth many times its cost," is fully justified.

Modern Milling. Being the substance of two addresses delivered by request, at the Franklin Institute, Philadelphia, January 19th and 27th, 1881, by Robert Grimshaw, Ph.D., Member of the Franklin Institute, etc. Twenty-four illustrations. Philadelphia: Henry Carey Baird & Co. 1881. Price, $1.

The above work outlines in popular form the changes that are taking place in the great and growing flouring industry, to which this country already owes so much. The subject is treated in Mr. Grimshaw's usual lucid style, and his analysis of methods and processes is scientific and comprehensive. The work will be found very useful by millers and others who are interested in the subjects of which it treats.

OTHER PUBLICATIONS RECEIVED.

God Bless the Little Woman. Song and chorus. Published by F. W. Helmich, Cincinnati, O.

Storm and Stress. Address of John Swinton, held at the Social Democratic Festival, Chicago, June 12, 1881.

First Annual Report of the Astronomer in Chief of the Horological and Thermometric Bureaus of the Winchester Observatory of Yale College. 1880-1881. Presented to the Board of

Managers at their meeting June 3d, 1881. By Leonard Waldo, New Haven, 1881.

American Chemical Journal. Vol. III., No. 3. From the Editor.

American Institute of Mining Engineers. Miscellaneous papers. From the Secretary.

First Annual Report of the Women's Silk Culture Association of the United States, for the year ending April 19, 1881. Philadelphia, 1881. From the Secretary.

Proceedings of the Engineers' Club of Philadelphia. Vol. II., Nos. 1 and 2. From the Society.

Kentucky Geological Survey and Bureau of Immigration. Information for Emigrants. The Climate, Soils, Timbers, etc., of Kentucky, contrasted with those of the Northwest. By John R. Proctor. Frankfort, Ky.: State Print. 1881. From the Director.

Summary Statement of the Imports and Exports of the United States, for the month ended May 31, 1881, and for the eleven months ended the same, compared with the corresponding periods of 1880. Prepared and published by the United States Bureau of Statistics. [Corrected to July 7, 1881].

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2862) The Spheroidal State.—I have seen the statement that some steam boiler explosions were due to the spheroidal state, whatever that may be. Will you please explain it in your next, and oblige a subscriber to your journal.—J. M. W., Watertown, N. Y.

(2863) To Detect the Pollution of Drinking-Water.—Several cases of typhoid fever have occurred among the inhabitants of a crowded quarter of this town, peopled by workingmen's families. I strongly suspect that the cause of the trouble is the use of polluted water. All of these people draw their water for domestic and drinking purposes from shallow wells, and of these several are located within forty feet of the privy well of a factory which daily receives the excreta of about thirty operatives. I have expressed my suspicions to the superintendent of the factory, but he is quite indifferent, and really too ignorant to understand the case. One death has already occurred, and there are now three cases on my hands. Now, what I wish you to do for me is this: Give me a simple suggestion or plan by which I can prove *positively* whether my suspicion is correct that the contents of the factory cesspool does gain access to the wells by infiltration. If I can lay positive proof of this fact before our town authorities, they will compel the owners of the factory to remove their cesspool, and construct one that shall be completely water-tight. Without positive proof, however, I can do nothing, and other lives may be sacrificed. Your prompt answer by letter may be the means of saving human life, and will greatly oblige an anxious physician.—M. D., Gloucester, N. J.

(2864) Hecktograph with Printers' Ink.—Can you give me any method by which I can use the hecktograph with printers' ink? I find the common method of copying with aniline ink is not entirely satisfactory. E. D. L., Jersey City, N. J.

(2865) Infusorial Earth.—Please inform me where I can get quantities of infusorial earth, and about what its market value per ton would be, landed at Baltimore.—R. W. B., Baltimore, Md.

(2866) Galvanic Deposition of Iron.—Have any methods been devised for coating metallic surfaces with iron in the battery? It appears to me that iron-faced printing plates should be more durable than stereotype or copper, if they could be cheaply made.—C. H. Van W., Tiffin, O.

(2867) Fire-Proofing Shingle Roofs.—Is there any cheap and simple way of making shingle roofs fire-proof?—W. R. T., Wheeling, W. Va.

(2868) Upward Discharge of Lightning.—Can there be an upward stroke of lightning—that is to say, a stroke from the earth upward to a cloud?—E. R., Galveston, Tex.

(2869) Evaporation.—What quantity of water can be evaporated by the steam generated by the average 20 horse-power boiler at a moderate pressure (by means of a steam jacket), from a body of water 10 feet square and 15 inches deep, in 8 hours' time? If the dimensions, etc., are not convenient for you to answer, give the proportions to suit your own advantage. By answering the above, you will greatly oblige a constant reader.—H. G. H., Philadelphia, Pa.

(2870) Formula for Converting French Metrical Units into English.—Give me a formula to reduce French measures of weight into Troy, thus: 20 grammes, 3 decigrammes, and 5 milligrammes. What is the amount in Troy pounds?—J. T., Newark, N. J.

(2871) Reducing Platinum.—Please give me the best modern method of reducing large quantities of platinum.—J. T., Newark, N. J.

(2872) Flow of Air in Pipes.—What amount of air will pass through a ½-inch pipe at a pressure of 1 pound to the square inch?—J. T., Newark, N. J.

(2873) Distance of Boiler from Engine.—Would it be advisable to have the steam boilers about 400 feet away from the engine? On account of the danger of fire and several other reasons, we would prefer this.—J. Y. S., Berlin, Ont., Canada.

(2874) Loss of Steam Pressure.—What amount of loss would there be in the steam in going a distance of 400 feet, if well protected? and how much higher pressure would be required to have the same pressure on the engine as if boilers are only 20 feet from the engine and pipes not at all protected.—J. Y. S., Berlin, Ont., Canada.

(2875) Protecting Steam Pipes.—What would be the best method of protecting steam pipes?—J. Y. S., Berlin, Ont., Canada.

(2876) Pavements.—There is one important item left out in your reply to Query 2855, on pavements, namely, the relative cost of the granite and asphaltum pavements.—Liberal Sentinel, Middletown, N. Y.

(2877) Cement for Aquaria.—Please give me a receipt for making a good water-proof cement that will answer for an aquarium.—F. C., Pittsburgh, Pa.

REPLIES.

(2701) Recovering Tin from Scrap Tin.—We may add to our reply to C. H. H., of Greenpoint, N. Y., (*vide* Query 2701), the following details of a new process for utilizing tinners' waste and scrap tin, which appears to have considerable merit, although for the reason named in our former reply to this question, it is doubtful if any plan that could be devised would yield much profit to its undertaker. The new plan we refer to is apparently an English one, as we find it described in one of the English technical journals. We glean from that source the following points bearing on this topic: Melting the scrap gives only a spongy iron, and the extraction of the tin by the action of acids or chlorine gas is too expensive, so that hundreds of tons of this material are wasted every year, and all the experiments to save it appear to prove abortive. The latest experiments, however, seem to promise a cheap method of recovering both the tin and iron in a pure and useful shape. The tin scraps are placed in a furnace where the temperature and the supply of air can be carefully adjusted. This gives a roasting in free air that causes the film of tin on the iron to oxidize. The alloy of tin and iron under the film of tin is next oxidized, and then the scrap is taken from the furnace, and the coating of oxides on the iron is shaken off by simple machinery. This leaves the iron in a comparatively pure state, while the powdered oxides may be smelted with other tin ores, or, as is preferred by the inventor of the process, they may be submitted to the action of hot sulphuric acid, which dissolves the oxide of iron, leaving the tin untouched. The tin may then be separated from the solution of sulphate of iron and melted, while the solution may be evaporated to dryness and then placed in retorts to recover the sulphuric acid, the residue in the retorts being valuable in making paints. The waste heat from the retorts is used to assist in roasting the scrap, and in evaporating the solution of sulphate of iron. Waste fruit tins are first roasted to remove the solder that may cling to them, and are then treated by the same process. The process is one that it may be hoped will save a great deal of money now lost without recovery, and do much to rid manufacturing cities of many unsightly heaps of refuse.

(2862) The Spheroidal State.—From the nature of this inquiry, we infer that our correspondent is not familiar with the physical phenomenon which has been called the spheroidal state. To explain it fully would take up too much of our space. We can only, therefore, give him a brief explanation of the phenomenon, referring him for fuller information to the works on natural philosophy in which it is explained at length. It is a matter of common observation that drops of water thrown upon a smooth and highly heated metallic surface, will not be instantly dissipated into vapor, but will assume the form of flattened spheres and roll quietly about, gradually growing smaller until they have completely evaporated. Other liquids besides water, will, under similar circumstances, behave in the same manner. This phenomenon is known as the spheroidal state of liquids. The principal condition necessary to produce it, is that the temperature of the heated surface shall be considerably above the boiling point of the liquid. An investigation of the liquid globule in the spheroidal condition will reveal the fact that the temperature of the spheroid is always less than the boiling point of the liquid. The temperature of the water spheroid, for example, is 205.7° Fah., or about 6½° below its boiling point. Furthermore, it has been found that a liquid in the spheroidal state is not in contact with the heated surface beneath. In explanation of this singular condition, it may be remarked that as the temperature of the plate is very high, the water that momentarily comes in contact with it, is instantly flashed into steam, on which the spheroid is supported as on a cushion. Again, the vapor being a poor conductor of heat, prevents the rapid conduction of heat from the heated surface to the liquid globule, hence its evaporation is retarded. As soon, however, as the temperature of the heated surface falls low enough to permit of the actual contact of the liquid with the metal, the water spheroid that had hitherto been rolling quietly about, at once flashes into steam with almost explosive violence. These are the most important facts connected with the spheroidal state of liquids, which affords a very curious and instructive subject for study and experiment. The relation of the spheroidal state to steam boiler explosions is not very difficult to understand from the explanation above given. Whenever, from any cause, the water is allowed to get very low, as where by negligence or otherwise the pumps fail to keep up the supply as the water is evaporated, or when, in the case of a steamboat, by careening, a portion of the flues are laid bare while the fire is still kept up, the exposed parts of the boiler may become highly heated. When water comes in contact with such overheated surfaces, it might readily assume at first the spheroidal state, and as soon as contact between the metal and water was established by the cooling of the metal, a large volume of steam would be suddenly generated, which, as can readily be perceived, might bring so violent a strain on the boiler as to burst it. This condition of things does not often occur, but we think very probable that explosions of steam boilers have taken place, and do take place, from this cause under the circumstances described. In the case of steamboats, for example, it has been remarked by those who have given the subject their attention, that the most frequent cases of explosion have occurred just at, or just after, leaving a landing. In such cases it appears likely that while unloading or taking on freight, the boats had careened, thus bringing a portion of her boiler flues out of water and allowing them to become dangerously overheated.

(2863) To Detect the Pollution of Drinking-Water.—The case as stated by this correspondent is not an uncommon one. If the truth were half known, we are of opinion that the circumstances narrated by him could be duplicated in thousands of situations all over the country. It is not often, however, that physicians trouble themselves to give the circumstances of a local fever epidemic such intelligent investigation as our correspondent has done. His suspicions as to the cause of the infection in the case he reports are certainly justified if the facts are as he states them; and without desiring to prejudge the case in advance of positive proof, we think the chances are ten to one that he is right. We gladly respond to his request for a simple plan by which he can prove whether his suspicions are right or wrong. Procure a small quantity—say 50 to 100 grains—of aniline red (which is a substance possessing remarkable tinctorial power) and introduce it into the cesspool. If there is any infiltration of its contents into the neighboring wells, the presence of the coloring matter will certainly be distinctly noticeable by its coloration of the water after a few hours. Another plan similar to the above, and perhaps even better, would be to introduce into the cesspool say about 25 or 50 grains of a lithia salt. Lithia gives a very characteristic line in the spectroscope which cannot be mistaken for anything else, and after a few hours, if there was any infiltration from the cesspool into the wells, its presence could undoubtedly be recognized instantaneously in the spectroscope. It would be necessary, if the latter plan were used, to first make sure by previous examination that the water contains no trace of lithia; as lithia is a comparatively rare substance, it is very unlikely that any would be detected. The precaution, however, is necessary. Either of the above suggestions will fully answer our correspondent's purpose.

(2864) Hecktograph with Printers' Ink.—A plan for copying with the hecktograph, using printers' ink in place of aniline, was described on page 40 of our February number for 1880, which this inquirer may find serviceable. A more satisfactory process of this kind, however, which has lately been brought to our notice, is the following: It depends upon the tanning of the superficial layer of the gelatine plate upon which the writing is made. Wherever this tanning takes place (that is, upon the written characters), the gelatine is rendered insoluble. These portions, however, will take fatty ink, while the rest of the gelatine surface will reject it. In practice, the operation is as follows: The copy is written on paper with a common nutgall ink, which has been made more astringent by the addition of a little tannin (or extract of logwood). This is transferred to the common hecktograph plate in the ordinary manner. Those portions of the plate on which the transfer adheres, become tanned, and on applying a roller charged with printers' ink to the gelatine surface, the ink will be rejected by the gelatine surface and will only adhere to the portions that have been tanned—that is, to the written characters. By laying a sheet of dry paper on the plate and applying gentle pressure with a roller of wood, rubber or paper, an impression of the copy in printers' ink is obtained. The hecktograph is then inked for another impression, and so on. The plate must be inked for each impression. Beyond these there are no special instructions. The process, in addition to the hecktograph, calls for a slab of glass or a zinc plate, for spreading the printers' ink, a small printers' inking roller with a handle, and another roller of rubber, paper or wood for pressing the paper equally against the pad in making copies. By this process, it is said that with a little practice 300 to 400 sharp copies can be made on dry paper.

(2865) Infusorial Earth.—From an article on infusorial earth, prepared by the writer some years ago, we name the following localities where infusorial earth has been found in sufficient quantity to pay for its extraction. The most extensive deposit in the United States is that upon which the city of Richmond, Va., is built. This deposit is in places 30 feet in thickness, and has been traced by Prof. W. B. Rogers, who was the first to point out its nature, from Herring's Bay on the Chesapeake (Maryland) to Petersburg (Virginia), and beyond. At the last named locality, the deposit is 30 feet in thickness. The quality of the earth from this extensive deposit is not uni-

formly good, but at many localities there is no doubt it could be obtained sufficiently rich in soluble silica to warrant its utilization. Next in magnitude come the deposits in California and Nevada, which are extensive and very pure. They are utilized extensively in the manufacture of polishing powder, which is sold under the trade names of "Magic Brilliant," "Electro-Silicon," etc. A notable deposit of this earth occurs at Drakeville, Morris county, N. J., which was first fully described by the writer. An account of this deposit will also be found in the annual report of the State Geologist of New Jersey for 1874. The deposit is not very extensive, but its quality is good. A giant powder factory located at McCainsville (near Drakeville), is said to be using the Drakeville earth. Other deposits of lesser note are found in various sections of the country, in swamps, peat bogs, etc. Of these, perhaps the only ones worthy of mention occur at Wrentham and Andover, Mass.; Smithfield, R. I.; and Stratford, Conn. None of these, so far as the writer is aware, are of sufficient extent to warrant their working. It is probable that in case constant supplies in considerable quantity were required by this inquirer, that he could make arrangements to get it from Maryland and Virginia sources, laid down in Baltimore, for say $15 to $18 per ton (dry weight). The Drakeville earth is delivered in New York or Philadelphia at $20 per ton, and for large supplies could be furnished at a cheaper rate.

(2866) GALVANIC DEPOSITION OF IRON.—Printing plates of stereotype metal, and especially those of copper (made by electrotyping), have a surface sufficiently hard and resistant to wear, to give many thousand impressions in the printing press before they show signs of wear—that is, where they do not suffer rough usage; and they are so cheap that there is hardly room for any material improvement upon them. Nevertheless, while we do not think much of our correspondent's suggestion to use iron-faced plates for printing as a substitute for those before named, we readily accede to his request to know if any methods have been devised to deposit a galvanic coating of iron. Several such plans have been proposed, and we give the more important of these below. Boettger, in 1846, described a process for obtaining galvanic deposits of iron, and employed for this purpose a solution of two parts of sulphate of iron and three parts of sal-ammoniac. Klein improved upon this by using sulphate of ammonia for the chloride. As an anode he used an iron plate, but explains that he found it expedient to connect this with a copper plate. He found the deposits he obtained were very hard and brittle; but he succeeded in rendering them ductile by heating them to a red heat. Varrentrapp recommends that an iron wire be connected with the iron anode, and that the anode and cathode be brought within four or five inches of each other. He employs as his solution four parts (by weight) of green vitriol, and three of sal ammoniac, in thirty parts of water. When metal molds are used, he suggests that they be first silvered, and then given a yellow coating of sulphide by the action of sulphuretted hydrogen, which allows the iron shell to come away freely. The current should be weak and constant to obtain the best effects.

(2867) FIRE-PROOFING SHINGLE ROOFS.—Spon, for this purpose, recommends a wash composed of lime, salt and fine sand or wood ashes, to be applied as in putting on a coat of whitewash. This coating, he adds, will render an ordinary shingle roof fiftyfold more safe against fire from falling cinders in case of a neighboring fire, than one without it. He adds, also, that it will have a preservative effect on the shingles, protecting them against rotting from exposure to the weather, and against warping, and states that the older and more weather-beaten the shingles are the more benefit they will derive from this application. He recommends, finally, that a small quantity of lampblack be mixed with the wash, to give the coating a darker color, thus avoiding the offensive glare of a white-washed roof. We have no doubt that the application above described will be found as simple and effective as any that could be suggested. Some years ago considerable attention was attracted to a process devised by Mr. G. B. Smith, for rendering shingles imperishable and fire-proof, by treating them, prior to use, in a boiling bath of various antiseptic mineral salts. By this treatment the shingles were impregnated with the chemical substances, and thus rendered much more durable against rotting and much safer from danger against fire. Mr. Smith employed, if we remember rightly, a mixture of chlorides. We do not know if these prepared shingles are now being made and sold, but some such process as this would certainly be much more effective than the laying on of a fire-proof coating afterwards.

(2868) UPWARD DISCHARGE OF LIGHTNING.—The lightning discharge is usually between two oppositely electrified clouds, or between the clouds and the earth. There are circumstances, however, under which an upward discharge from the earth to the clouds may occur. For example, a highly electrified storm-cloud extending over several miles, and inducing the opposite kind of electricity in the earth beneath it, may approach near enough to the ground to overcome the resistance the atmosphere offers to the restoration of electric equilibrium; and in such cases a flash of lightning at one extremity of the cloud may be followed by a corresponding discharge in the reverse direction (upward) at the other extremity miles away. This last named discharge is called the "return stroke," and is frequently of great violence and attended with disastrous or fatal results to property and life. The physical evidences of the upward stroke are often apparent to the eye, in the rending asunder of rocks and the tearing up of the surface earth, the stripping off of the bark of trees from below, and the like. The eye is not a safe judge of the direction of a lightning discharge, whether upward or downward, for the reason that the duration of the flash is so inconceivably small—not exceeding the millionth part of a second—that the eye, directed upon a piece of ground upon which a flash should descend, would observe the terminus of the flash first, and thus the illusion of an upward stroke would be impressed upon the eye.

(2869) EVAPORATION.—So much will depend on conditions that are not stated in this inquiry, that no accurate reply can be given to the question. Making a rough approximation, we should say that the evaporative efficiency with "second-hand" evaporation would probably be about 4 pounds of water per pound of coal per hour. Knowing the coal consumption of his boiler, our inquirer can readily calculate the amount of water that would be evaporated at second-hand by this rule, remembering, as above said, that the result would only be roughly approximate. Among the variable conditions that will affect this result, are the following: Temperature of the water in the tank; distance of the tank from the boiler; thickness of the steam jacket, or rather of the layer of steam; whether evaporation is against air pressure, or is assisted by vacuum, as in sugar making; the perfection of heat insulation of the jacket; and other conditions of lesser importance. If our correspondent desires to get the largest possible evaporative effect, we would suggest that he employ a steam coil in place of the steam jacket.

(2870) FORMULA FOR CONVERTING FRENCH METRICAL UNITS INTO ENGLISH.—We give this correspondent the following working formula for the conversion of French metrical units into English, and *vice versa:*

1. *To Convert Grains into Grammes:*
Log. grammes=Log. grains+(−2.8115680).
2. *Grammes into Grains:*
Log. grains=Log. grammes−(−2.8115680).
3. *Cubic Inches into Cubic Centimetres:*
Log. cubic centimetres=Log. cubic inches+1.2144993.
4. *Cubic Centimetres into Cubic Inches:*
Log. cubic inches=Log. cubic centimetres−1.2144993.
5. *Inches into Millimetres:*
Log. millimetres=Log. inches+1.4048337.
6. *Millimeters into Inches:*
Log. inches=Log. millimetres−1.4048337.

To test the correctness of these formulæ, we will select the example propounded by our correspondent, namely, to convert 20 grammes, 3 decigrammes and 5 milligrammes (20.305 grammes) into Troy pounds. By formula (2) we have

Log. grains=log. 20.305−(−2.8115680)
Log. 20.305=1.307603
2.811568
———
2.496035

The natural number corresponding to this logarithm is found to be 313.35, which is the number of grains equivalent to 20.305 grammes. To prove the correctness of the method, it is only necessary to recall the fact that 1 gramme=15.4324 grains. By multiplying 20.305 by 15.4324, we obtain as the result 313.3548 grains, which corresponds to the answer obtained above. To convert these grains into ounces or pounds, proceed according to the table of Troy weight, by which 313.35 grains=.653 oz. (nearly seven-10ths of an ounce), or .0544 lb. (about five-100ths of a pound).

(2871) REDUCING PLATINUM.—The best method of reducing platinum in quantity, so far as we know, is that of Deville and Debray, two French chemists who have given much study to the subject. By this process the metal is extracted in the dry way. We can only give here the outlines of the process, referring our inquirer to the large works on metallurgy where it will be found in detail. They mix the ore with 4 to 5 per cent of lime, and smelt it in a lime furnace composed of lumps of well-burned lime suitably placed so as to allow of a hollow space for the ore mixture, which is introduced through an opening in the roof provided for the purpose, and which is kept closed during the operation by a plug of lime. A suitable opening is provided for pouring out the fused metal, and the furnace is provided with a handle or lever below to enable it to be tilted in pouring out the charge. The top of the furnace is provided with two copper tubes joined at their lower parts on tubes of platinum embedded in the lime that forms the roof of the furnace. These tubes communicate with the interior of the furnace, and serve to admit hydrogen (or carburetted hydrogen) and oxygen gas into the furnace, the supply of the gases being regulated by stop cocks. The combustion of these gases furnishes the most intense heating effect, and the ores are gradually fused. The flame should be regulated so as to melt the charge gradually, by which procedure most of the impurities present are either volatilized or oxidized. When the charge is completely fused, the furnace is tilted and the fused metal is poured into ingot molds of sand, lime, gas coke, or cast iron brushed with plumbago. Old platinum may be re-melted in this way in charges of 50 pounds; and ingots of platinum weighing several hundredweight, produced at one smelting, have been made. We suggest to this inquirer to refer for full details of this process to Crookes & Rohrig's, or Percy's, Metallurgy.

(2872) FLOW OF AIR IN PIPES.—A similar question was answered in our June number for 1880, page 144, Query 2637. Our inquirer omits one important element in stating his example—that is, the length of his pipe, which will exert an important influence on the quantity of the discharge. Without this factor being stated it is impossible to give a definite solution to his problem. If he will give us this missing element, we will be pleased to work out the example in our next month's issue. We also restate the formula given in our former reply, by which he can work out the result himself. The formula stated below has been established by Clegg and others to serve the needs of the gas-works engineer. The modifying elements of friction, varying specific gravity of gases, length of pipe, etc., necessarily make it somewhat complicated.

Let Q=quantity of gas (air) issuing per hour in cubic feet.
l=length of pipe in yards.
d=diameter of pipe in inches.
p=pressure in inches of water.
s=specific gravity of gas (air=1).

Then $Q=1350d^2\sqrt{\frac{pd}{sl}}$

Stated in words, this equation would read as follows: Multiply the pressure in inches of water by the diameter of the pipe in inches. Divide this product by the specific gravity of the gas multiplied by the length of the pipe in yards. Extract the square root of this quotient, which root, multiplied by the constant quantity 1350 and the square of the diameter in inches, gives the number of cubic feet discharged in one hour. In working this formula, our correspondent must remember to convert his pressure in pounds to the square inch to inches of water. One pound pressure per square inch would be represented by a water column 27.7 inches.

(2873) DISTANCE OF BOILER FROM ENGINE.—Unless it is necessary, or desirable, by reason of danger from fire, increase of insurance rates, or other valid reasons, it is never advisable to put steam boilers any great distance from the engines they are to drive; 400 feet is an exceptionally long distance, involving considerable expense for piping and laying, with not only increased liability to leakage, but also a very marked degree of condensation or reduction of temperature and pressure, and consequently loss of power. There is, likewise, a further disadvantage in having the boiler so far from the engine—namely, that in the event of an accident to the engine, it takes a long time to communicate with the fireman to shut steam off at the boiler and bank or draw his fires. With the boiler conveniently near the engine, where it is the invariable rule to place it, save in very exceptional cases, the disadvantages above named are avoided; and in addition, the engineer in charge can oversee the boiler and fireman, and can advise himself from time to time of the steam pressure the boiler is carrying, thereby exercising a species of superintendence which may measurably lessen the danger of explosion.

(2874) LOSS OF STEAM PRESSURE.—The amount of loss in steam pressure where steam is carried a distance of 400 feet in well protected pipes, and the excess of boiler pressure needed over the desired initial cylinder pressure, depend on too many conditions to be answered in a general way. The elements that would have to be stated would be the desired initial pressure at the engine; the amount of steam used in a given time; the degree of dryness of the steam; the diameter, length, material and thickness of the steam pipes, whether straight or curved, overhead or under ground, and if the latter, whether laid deep or shallow, and the character of soil or surrounding medium; average and maximum temperature of air or soil; if passing overhead, whether traversing a windy or sheltered space, etc. If this inquirer will give us the above named details, we will be more explicit. No specific answer in quantities can be given to his general question. If details are given, we will hazard an opinion based on all the facts, which will be safely approximate.

(2875) PROTECTING STEAM PIPES.—As regards the best method of protecting steam pipes, floculent or fibrous materials which are poor heat conductors, are to be preferred, and, if possible, an air space should be left between the pipe and the inner wall of the covering. Hair, felt, loosely felted wool shoddy, so-called mineral wool, asbestos, cork scraps, etc., are all good non-conductors. A trench about the pipe, filled with sawdust, answers very well for underground pipes.

(2876) PAVEMENTS.—The question of relative cost is, of course, an important practical element in connection with the subject of this inquiry. The wording of the question, however, was such that we did not deem it necessary to consider this factor in our answer of last month. Respecting the relative cost of granite and asphaltum roadways, we can only say that in Paris it has been found that the asphaltum costs about one-third less than granite, and the cost of its maintenance is estimated to be about three-quarters that of macadamized roads. In France and Germany, however, supplies of rock asphalt (from Val de Travers or Seyssel) are near at hand and readily obtainable. In this country we have not yet found supplies of natural rock asphalt, corresponding in quality to the famous deposits above mentioned, and thus far we have been obliged to depend upon the natural asphaltum from Trinidad. On this account, the cost of good asphaltum roadways will probably fully equal, if it does not somewhat exceed, that of granite.

(2877) CEMENT FOR AQUARIA.—The following, which is a standard recipe, for this purpose will be found to give results in every way satisfactory: Take of litharge, fine white sand and plaster of Paris, each 3 parts; finely powdered rosin, 1 part. Mix with enough boiled linseed oil to make a homogeneous paste, add a little dryer, and thoroughly incorporate the mass with a spatula or knife-blade. The cement should be allowed to stand for three or four hours before using. It will be found equally serviceable for salt or fresh water tanks.

THE MANUFACTURER AND BUILDER,

Vol. XIII.—No. 10. OCTOBER, 1881. THIRTEENTH YEAR.

Westcott's Combination Lathe Chucks.

We present in the following a description, with illus-

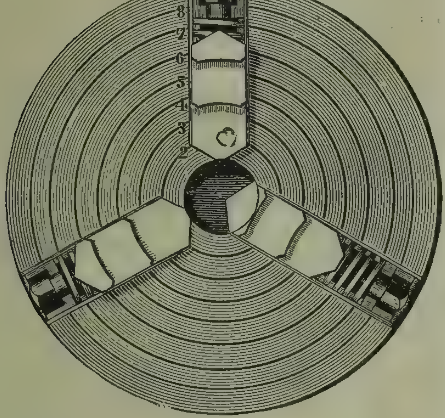
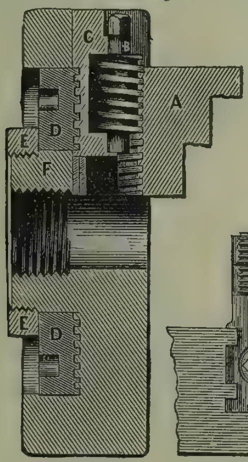


Fig. 1.

trations, of several improved forms of lathe chucks, manufactured by the Oneida Steam Engine and Foundry Co. For these devices, it is claimed that they contain all the good points of the great variety of chucks with which machinists are familiar, and in a combination at once simple, strong and practical, re-



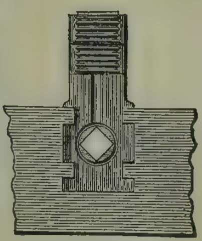


Fig. 2. *Fig. 3.*

quiring however the best materials and mechanical skill in their manufacture, in order to secure that accuracy, strength and facility of adjustment that are the principal requisites in machinists' tools.

The Oneida Steam Engine and Foundry Co. under-

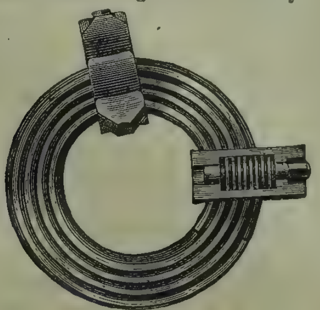


Fig. 4.

took the exclusive manufacture of these devices shortly after their invention, with a full appreciation of the difficulties to be encountered, and they have had the satisfaction of meeting with a very gratifying success. The company's manufacture of J. H. Westcott's combination scroll lathe chuck—the earliest of Mr. Westcott's inventions in this line—commenced some seven or eight years ago, and from its first introduction there has been a constantly increasing demand for it to such an

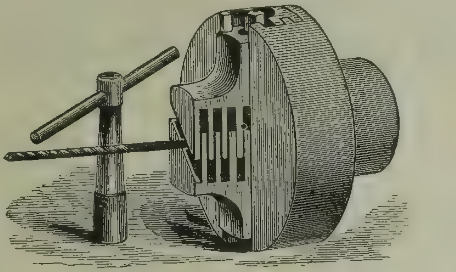


Fig. 5.

extent that the company have made its manufacture to this time a specialty. Referring to the special features of the combination scroll chuck, the makers affirm that the invention of Mr. Westcott provides a device that is perfectly adapted to the varying wants of the ma-

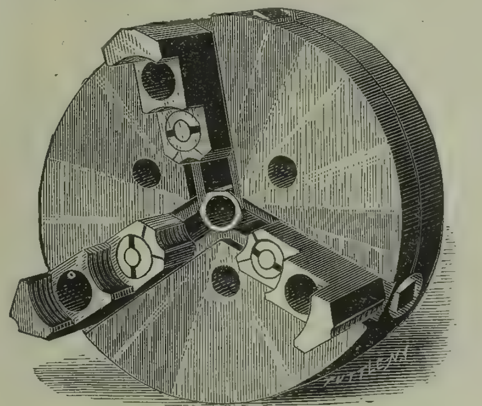


Fig. 6.

chinist. The improvement consists in not only making the jaws reversible, by which arrangement the small sized chucks can be used with facility in holding screws, pipes and drills, but also in making them act independently of each other when required, as well as

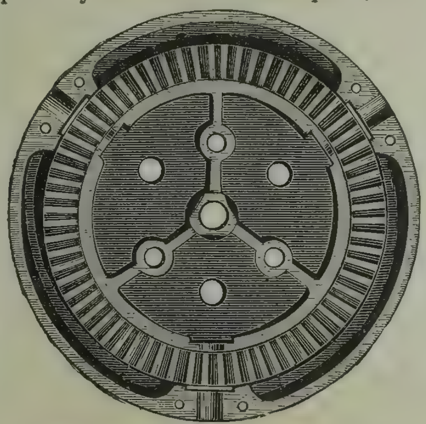


Fig. 7.

to act concentrically and simultaneously. This chuck is, therefore, enabled to seize and hold firmly, round, oval, oblong or eccentric shapes, as well as to hold work in an eccentric position.

The details of the construction and the action of this device will be seen by consulting the annexed engravings, in which Fig. 1 represents a front view of the

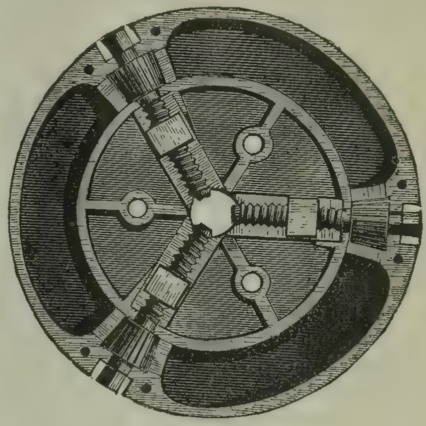


Fig. 8.

chuck, with one of the jaws reversed; Fig. 2 a vertical section, showing the manner in which the ring D engages in box C, and the position of screw B. Fig. 3 is a section of the chuck showing end of screw and box

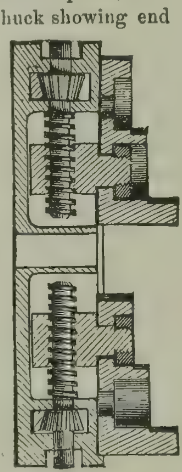
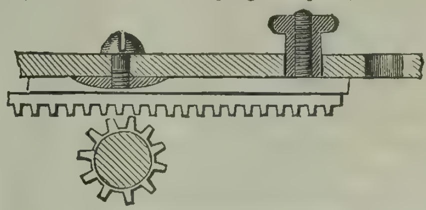
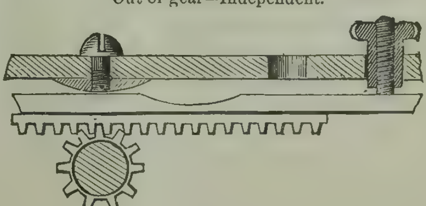


Fig. 9.

C; also the strong and durable manner in which all the parts are secured to the body of the chuck. All screws, and the boxes carrying the jaws, are made of



Out of gear—Independent.



In gear—Universal.

Fig. 10.

the best cast steel, the jaws, wrenches and scroll ring of the best hammered iron, made epecially for this

work. The jaws and all wearing parts are thoroughly case-hardened. Fig. 4 shows the inside of wrought-iron scroll ring with steel box and the steel screw, by using which the independent action of the jaws is obtained.

The makers give the following directions for using the Westcott combination scroll chuck: To get the full capacity, run the boxes out to the stop, by using a scroll wrench; then with a key wrench run the jaws out over the box. This gives a double support, and from two to seven inches larger working capacity than diameter, according to the size of chuck. If the jaws have been used out of the circle and are wanted to work centrally, run the jaws so that the mark on the side of the same shall be on the same line on the face of the chuck. A little good oil should be applied occasionally to the shoulders of the screw in the box, also to the thread on the scroll, for which an oil-hole is drilled in the face of the chuck and marked "oil."

Fig. 5 represents a drill chuck of the Westcott pattern, known to the trade as the "Little Giant," and shows a face view of the inter-penetrating arrangement of the jaws. The hole in these chucks is not obstructed, and a rod can be run through if desired, the screw moving the jaws being outside of the center. This drill chuck is very popular with machinists, jewelers and cabinet-makers, the latter using it for holding burs in molding and carving.

The remainder of the engravings refer to Westcott's combination geared lathe chuck, a more recent improvement of the same inventor, manufactured by the above named company. This chuck embodies Mr. Westcott's later improvements, the company having complete control of all of Mr. Westcott's patents on chucks. It is claimed to be the best geared chuck in the American market; it is made under the special supervision of the inventor, and they claim for it the following advantages over other geared combinations: 1. The jaws are held firmly to the face of the chuck by a stud and nut nearest the end of the jaw which holds the work, and which effectually prevents the jaw from springing, and also prevents all lost motion in the working of the jaw. By means of this improvement, the chuck can always be made a perfect universal, which is true of no other chuck, as the strain on an ordinary chuck soon wears the threads of the screws to such an extent as to make it an imperfect tool. 2. The jaws can be reversed in half the time of any other chuck made, as it is only necessary to take the nut off the stud and replace it after reversing the jaw. 3. The screw heads are countersunk into the edge of the chuck, so that there are no projections to cause annoyance. 4. These chucks will hold a piece of work from 1 to $2\frac{1}{2}$ inches larger than rated; at the same time they are no heavier than an ordinary chuck of the same size.

In addition to the foregoing points, the makers add that all the parts of this device are made interchangeable, so that if a part is broken it can be replaced without sending the chuck to the foundry to be repaired. There having been some changes of form during the past few years, however, there may be some difficulty in interchanging parts with chucks now manufactured. Attention is called to the ease with which cheap jaws of cast iron, requiring only shaping and drilling, may be substituted for the regular jaws whenever one has occasion to do brass work, turn rings, or to meet any of the thousand and one exigencies which will arise, and which ordinarily require one to have several different chucks.

Fig. 6 shows the appearance of the combination geared chuck; Fig. 7 is a view of the interior, showing the geared ring; Fig. 8 is an interior view, showing pinions and screws; Fig. 9 is a section showing one jaw reversed; and Fig. 10 shows the device when out of gear—independent, and when in gear—as a universal.

The makers give the following directions for using their combination geared chuck: In changing the chuck from independent to universal, bring the jaws out to the surface and adjust the screws to the line; then with a rocking movement of the wrench while pressing on the shifting nut, the rack rolls readily into gear. The change from universal to independent is made almost instantaneously by sliding a stud on the back of the chuck. When requiring the full power of the chuck, and to make it perfectly true, it is necessary to be careful to take up the slack on each screw.

Respecting chucks for special work, the makers represent that they have unusual facilities for meeting any demands that may be made upon them, by reason of the large amount of special machinery they require to use in their special branch of manufacture. They have lately doubled their capacity, but still are unable to get any stock ahead, being a month or two behind their orders at this time.

Mr. A. E. Hawley is General Superintendent, and, with Mr. Westcott, was, previous to July 1st, employed by the Oneida Community (Limited). All chucks sent out are manufactured under Mr. Westcott's personal supervision.

Further particulars may be had by addressing the Oneida Steam Engine and Foundry Co., Oneida, N. Y.

The Manufacturer and Builder.

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Dust Explosions.

The recent violent explosion of dust in the malt elevator of one of the largest breweries in New York, calls for special mention, since it is a source of danger that is frequently overlooked, or very much underrated. There are so many manufacturing processes in operation which involve the production of combustible substances in highly comminuted form, capable, unless great precautions are taken to prevent it, of causing violent and disastrous explosions, that the real extent of the danger from this form of accident should be intelligently understood by all. It should be understood that the dust of such combustible substances as coal or grain, when mixed with air, in which it will float, is a dangerous explosive. It is only necessary, in this connection, to recall several notable cases of disastrous accidents happening from this cause, to impress the fact upon the mind. Of these we need only call to mind the explosion and burning of the Washburn, Diamond & Humboldt Flouring Mills in Minneapolis, which occurred on the 2d day of May, 1878, and which at the time attracted universal attention from its peculiar character and disastrous effects.

These mills were destroyed by the explosion of particles of flour and bran mixed with air, and the violence of the explosion was so great that brick walls six feet thick were thrown down, and portions of the iron roof of one of the mills were thrown upward with such force that they were carried away by the wind to a distance of several miles from the scene of disaster.

There seems to be good reason to believe, in the light of the frequent accidents of this kind that have lately been noticed, that many mysterious explosions and conflagrations may have been caused by the accidental ignition of mixtures of combustible dust and air. This is undoubtedly true of many of the explosions that occur in collieries, and which have been in many cases erroneously attributed to the presence of "fire damp." Of manufacturing establishments, flouring and grinding mills and breweries are most exposed to this form of accident, and the utmost precaution should be exercised to avoid them that intelligent supervision can devise. In some cases, however, no amount of precaution can avail to avert accidents of this kind, since a pebble or bit of iron, finding its way between the stones or steel grinders, will cause a spark which would, according to circumstances, cause a flash or an explosion in the highly combustible mixture in the exhaust flue. Accidents from these very trifling causes are simply unavoidable, and the fact that such danger is constantly present, should be known and understood.

It may be remarked in connection with the brewery explosion mentioned at the outset of this article, that a similar explosion of malt dust had taken place in the same establishment about a year previously, caused by the accidental presence of a lucifer match among the malt, which was ignited in the malt mill. Accidents of a similar character are reported to have occurred in two other breweries in this city, and it is probable that they are of common occurrence.

Respecting the character of these and similar dust explosions, Prof. L. W. Peck, who made a careful study of the subject immediately after the notable destruction of the Minneapolis flouring mills, gives the following

very practical illustration, which occurs in a lecture delivered on the subject: "If a large log of wood were ignited, it might be a week before it would be entirely consumed. Split it up into cordwood and pile it up loosely, and it would burn in two hours. Split it up into kindling-wood, pile it up loosely, and perhaps it would burn in less than an hour. Cut it into shavings and allow a strong wind to throw them in the air, or in any way keep the chips comparatively well separated from each other, and the log would perhaps be consumed in two or three minutes; or, finally, grind it up into a fine dust or powder, blow it in such a manner that each particle is surrounded by air, and it would burn in less than a second."

This illustration explains very clearly why mixtures of combustible dust and air are highly explosive, and therefore specially dangerous. The combustible material is in a very fine state of division and intimately mixed with the supporter of combustion, and the ignition of one set of particles being accomplished, the combustion is carried at once through the entire mass with explosive violence, as though it were an explosive gaseous mixture.

A Proposed Transcontinental Balloon Voyage.

The daily newspapers have lately been full of accounts of the building of a huge balloon to be used for experimental purposes, by Mr. Samuel A. King, better known to the public as Prof. King, a well-known and successful aeronaut. Prof. King's proposal is to make an extensive transcontinental voyage, for the purpose of testing the carrying power and tightness of his balloon, preliminary to the venturesome task of a transatlantic voyage. We have little faith that the last named foolhardy adventure will be attempted, however much it may be talked about. Even should it be undertaken and successfully accomplished, it is very questionable if the gain to the science of meteorology would be of sufficient importance to justify the imperiling of human life, which is proposed.

The paths of the great air currents circulating about the earth have been ascertained with tolerable accuracy already, and the existence in the Northern hemisphere of a constant current in the elevated regions of the atmosphere, having a prevailing northeasterly movement, is not only inferential on theoretical grounds, but has been demonstrated again and again by the experience of aeronauts. As this is about the only important point that a transatlantic balloon voyage, if it could be successfully accomplished, would be able to demonstrate, the folly of placing human lives in imminent peril for the trifling object of making "assurance doubly sure" on a subject upon which meteorologists are already of one opinion, is very apparent. It is true that the achievement of a transatlantic balloon voyage would give considerable notoriety to the successful voyagers, but the propriety of incurring the risks of such an undertaking, on such grounds, is even more questionable.

The experience of almost a century, from the first crude experiments of the Montgolfier brothers down to the sad event that terminated in the frightful death of John Wise, the only American aeronaut who ever contributed anything of value to science by his observations, and withal the most successful aeronaut of his day, has proved to the entire satisfaction of every intelligent person that the problem of aerial navigation, from the standpoint of utility and safety, is as far from being solved as it was at the close of the last century. It is almost as certain that it will ever remain so, for the elements of extreme hazard and uncertainty are inseparable from it, and cannot be eliminated. The balloon, in the hands of such men as Glaisher, Wise, and a few others of lesser note, has contributed slightly to our knowledge of meteorological phenomena, and has proved itself useful as a medium of placing the outside world in communication with the inhabitants of a beleagured city; but this is about all that can be said in its favor. It will probably always remain an erratic and dangerous plaything for prudent people to gaze at and thank their stars they are not aboard; the indispensable adjunct of the county fair, or the Fourth of July celebration, but nothing more.

Progress of Electric Lighting.

The Brush Electric Light Company is now engaged in making the necessary arrangements for the lighting of Chestnut street, one of the chief business thoroughfares of Philadelphia, from the Delaware river to the Schuylkill, a distance of about two miles. The proposition made by the company to the city, was to erect the necessary machinery and fixtures, to maintain the same in working order, and light the entire extent of Chestnut street for the period of one year, at their own expense, on the condition that the plant would be purchased by the city, and company reimbursed for its outlays, at the end of that period, should the experiment prove to be successful and its claims substantiated. This proposal was favorably received and accepted, and the company is now busily engaged in the construction and erection of the wires, lamps, posts and other appliances and machinery. The necessary arrangements are expected to be finished to inaugurate the electric lighting of the street on or about the 15th of October.

There will be 124 hollow iron columns along the street, the portion lighted being the two miles from river to river. About 100 of the columns are already up, the men having started at the Schuylkill and worked eastward. At the time of penning this they have progressed as far as Third street. All the columns are on the south side of the street, which is free from trees, excepting two columns in each square on the north side, one on the corner and one midway in the square. These mark the points where the trusses holding the lamps will be thrown across the street. The main line of iron supports, usually four or five in a square, will continue down the south side of the street as far as Fifth, where they will cross to the north side, which, from that point to the Delaware, is the least obstructed. The standards are joined in three hollow sections, and taper in diameter from 6 inches at the base to 3½ inches at the top. They are usually placed 5 or 6 feet in the ground, leaving a uniform hight of 25 feet above the sidewalk. After they are put up, they are painted a bright red, and, as seen extending in their uniformity the length of the great thoroughfare, they are not near so unsightly as the bulkier telegraph poles which overshadow them. In putting the corner and mid-distant standards in the ground, the upper portion is given a slight inclination towards the building, so that they will exert an additional pressure when fastened by the trusses. These trusses, which are to be of wrought iron, with braces, will be nearly arch-shaped, and will extend across the street at every corner and in the middle of every square. There will be 49 lamps altogether, and they will be suspended from the trusses immediately in the middle of the street. It is expected that the wires connecting the standards, and also running across the trusses, will make all the upright structures strong enough to resist even a hurricane; but this remains to be tested.

The wires will be of copper, and covered with gutta-percha, to guard against the contact of other electric wires, especially telephone connections. It is claimed that if a telephone wire should fall upon one of the light wires it would take two weeks of friction to bring about actual contact; but to guard against any such occurrence, it is intended to have a man go over the line daily to examine the wires and see that they are not interfered with.

The building to contain the power and machinery for developing and distributing the electricity is now being erected. The power will be furnished by six engines of 50 horse-power each, making a total of 300 horse-power. There will be a 40-light Brush electric light machine for each engine. Of these only five will be in operation at any one time, the other being reserved in case of accident. There will be an automatic attachment to every one of the 49 lights, whereby the carbon points will be brought into contact when the wires are free of electricity. The instant the current is turned on, the carbon points will separate, thus "springing the arc," as it is technically termed, and lighting every lamp simultaneously from the Delaware to the Schuylkill. The lamps will be lighted at sundown each evening and kept burning until sunrise next morning. There will be an automatic governor attached to the connected engines, by means of which, in case of breakage of any one and the consequent increase of strain upon the others, the reduction of power will be distributed evenly. In front of Independence Hall there will be two lamps larger and more ornamental than the rest, and placed on standards different from those used elsewhere.

The Foreign Commerce of the United States.

The Bureau of Statistics of the United States has just issued a report giving the figures of the foreign commerce of the country during the fiscal year ended June 30th, 1881. They show that for the period named, the exports of merchandise amounted to $902,-319,473, and that the imports of merchandise for the same period were $642,593,219, making an excess of exports over imports of $259,726,254. For the year ended June 30th, 1880, the exports were $835,946,353, and the imports $667,954,756, or an excess of exports over imports of $167,683,912.

From an inspection of the figures of the report referred to, it appears that, with the exception of two years (1862 and 1874), the balance of trade was steadily against the United States for a period of sixteen years—from 1860 to 1875, inclusive—the imports during the period named exceeding the exports by the sum of $1,175,609,561. During the succeeding six years (from 1876 to 1881), the exports have exceeded the imports by $1,180,681,641; so that in this comparatively brief period we have succeeded in equalizing our foreign business for the past twenty-two years, and this current of trade is still tending in our favor.

With respect to gold and silver, though the showing is not so good, the tendency of late years has been steadily and increasingly favorable. For the year ended June 30, 1880, we drew from foreign countries an excess of $75,891,390 in gold and silver over our exports; and for the year ended June 30, 1881, we imported a surplus of $91,168,650 over our exports, making an aggregate for the two years of $167,060,-041.

A continuance of the favorable conditions we have enjoyed, for a few years longer, will enable us to get back the bulk of gold and silver that we have sent to foreign countries during the past twenty years. The extent to which Europe has drained this country of its precious metals, will be appreciated from the statement that during the period of thirty years (from 1850 to 1879 inclusive), our exports of gold and silver exceeded our imports by the enormous sum of $909,829,417. Since the year 1879, the current has set in our direction; and during the two years that have followed, we have reduced the sum above named by nearly one-fifth. In about seven years more, supposing the flow of gold to this country to continue at the same rate as last year, our account with Europe for the past thirty years, in the item of the precious metals, like that of our commerce, will be equalized.

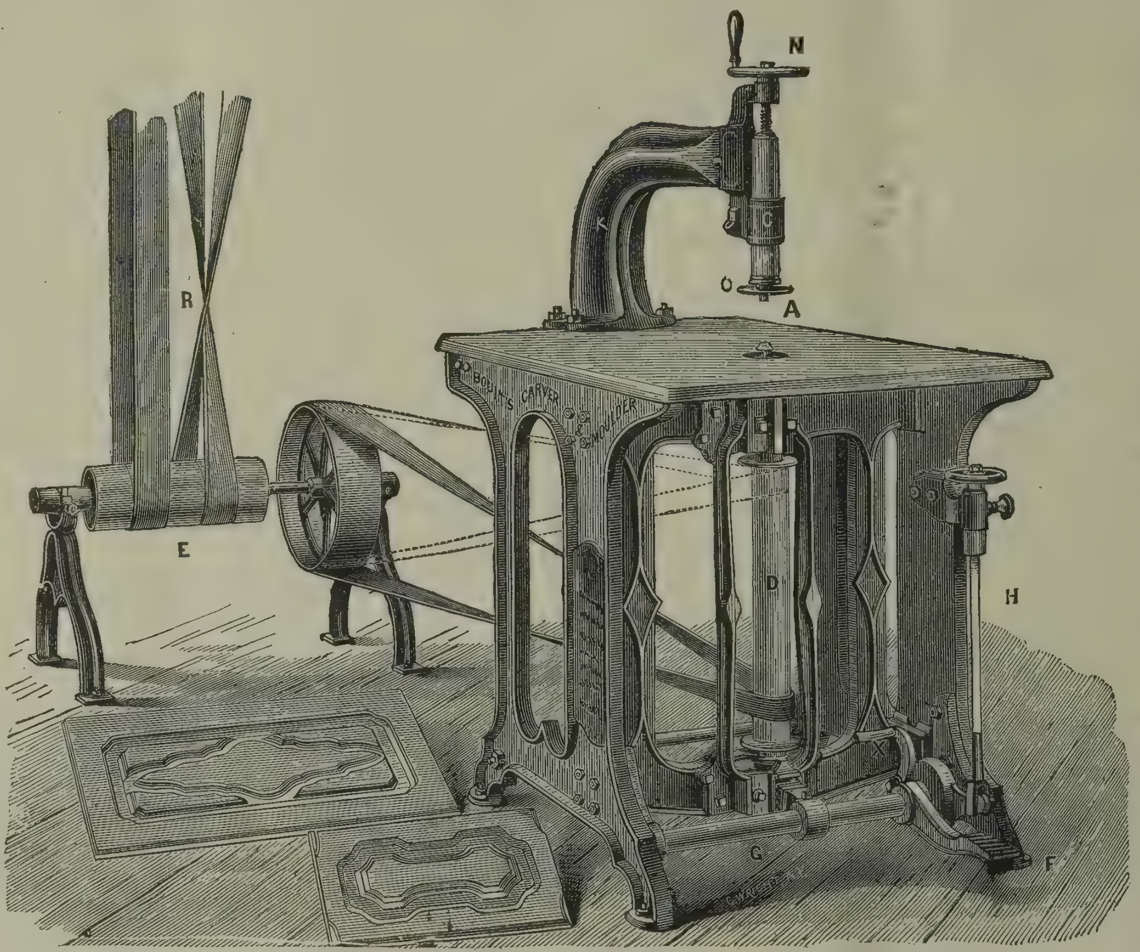
To correctly state our business condition with respect to foreign countries, would require us to take into account the large amounts of our government, railway and other securities on which we have borrowed money, and of which large amounts are still in possession of foreign holders. It is well known, however, that the quantity of our government securities held abroad has vastly diminished during the past few years; and though large amounts of our railway and mining securities are in foreign hands, the piling up of this form of indebtedness in foreign countries has also greatly diminished, the abundance of money at home seeking investment having rendered it unnecessary to seek capital abroad for new enterprises.

Boult's Improved Carving, Paneling, Molding and Dovetailing Machine.

Within the past few years there has been a very decided and desirable improvement in the character and cheapness of ornamentation in wood. These improvements have been most noticeable in the direction of paneling and edge molding. In these directions the design and finish have approached very closely to the practical realization of the ideals of Eastlake and others of that school, who have labored with much success to impress upon designers and artisans the artistic principle that ornamentation should possess the characteristics of strength and truthfulness.

Much of this improvement in the character of ornamentation in wood has been made possible—in fact, may be said to have been developed, by the introduction and extensive use of the admirable wood-working machines of Mr. Boult, which have been before the public for the past few years, and which, by reason of the extended variety of work for which they are adapted, and the excellence of their work, have acquired an acknowledged celebrity wherever wood-working machinery is known and used.

The machine of Mr. Boult, with a few simple changes of attachments, can be adapted equally well for the several operations of carving, paneling, molding and dovetailing, and is therefore specially adapted for the use of manufacturers of furniture, carriages, railway cars, pianos and organs, as well as for manufacturers of building supplies, and for almost every form of ornamental work in wood.



BOULT'S CARVER AS USED FOR SURFACE MOLDING AND PANELING.

It has been frequently urged as an objection to machines adapted to an extended variety of work, that they must be very complicated; the several changes required for variations, difficult and tedious to make; and the adjustment of the machine troublesome. These objections are in the main well founded. The machine about to be described, however, is a notable exception to the rule, being characterized by so much simplicity, that five minutes' time and the removal of a single bolt, is all that is necessary to effect the most radical change upon it. The extreme simplicity of the machine and the ease and celerity with which its several attachments may be attached and detached, no less than the surprising variety of work that the operator is enabled to accomplish with it, have caused it to become acknowledged as one of the most useful and valuable of wood-working machines, and have gained for it an introduction into the best wood-working establishments both at home and abroad.

Our engraving shows the Boult machine as used for surface molding and paneling. It is provided with rapidly rotating vertical cutters of solid steel, which will cut for themselves in the solid wood an accurately cut and finished path, leaving the panels raised or sunk, as may be desired. The character of the designs it is possible to produce with the machine, may be inferred from the samples observed at the base of the engraving; but they are almost infinite in variety, the capability of the machine being restricted simply by the impossibility of making a square or an acute corner to a sunken panel. Rosettes and edge moldings are readily and rapidly made. In all this class of work, the use of this machine means a large saving in material, while the accuracy and rapidity of its work leaves nothing to be desired on the score of beauty or of economy in labor.

In the paneling machine the cutters come up from below through a suitable orifice provided in the table. For bracket work, the cutter is still vertical, but is mounted above the table and works in sight. For elliptical moldings of any curve or radius, the cutter is adjusted vertically.

Describing the adaptability of their machine for these special uses, the makers speak as follows: "Carving, paneling and grooving are quickly and perfectly formed and molded to any design upon the surface of wood, for which a pattern or form may be provided, for ornamenting cars, fences, furniture, organs, buildings, carriages, coffins, newel posts and pew ends; also for cutting plain grooves, dados, etc., mortising and cutting dovetail dados for joining work together, and for all work necessary to be done on the surface of lumber in regular or irregular lines. The operator having at all times full control, is able to do all he wishes in a quick and perfect manner. By making all ornaments in the solid wood, many glue joints are saved, also a large percentage of time and material, and at the same time giving a better job. Thirty-three per cent less lumber is required to effect the same appearance than by the old method of 'planting on,' also six operations, namely, re-sawing, preparing the material, marking out, jig sawing, molding and planting on, either process requiring more time than it takes to make a better job by using the facilities afforded by Boult's machine. Every one is aware that work done in solid wood cannot come to pieces by hard usage or exposure to damp and heat."

By the use of a special attachment (not shown in our engraving) scroll, bracket or fret work, trimmings for balconies, verandas, drapery for cornices, decoration for churches, furniture, etc., can be done, molding all openings down to one-eighth of an inch. The most delicate points of the most elaborate fret-work are molded with safety and dispatch. In fact, molding with this part of the machine is carried to the farthest possible extent. As in the other parts of the machine, reverse motion is used to keep the knife cutting with the grain of the wood.

The uses of the bracket attachment are of the most varied character. It is adapted to inlaying, carving, tracing, engraving, grounding for carvers and engravers, letting in locks and hinges on sewing machines, drawers, etc., all of which is done expeditiously, and is of a kind never done before by machinery. It is also used for inlaying brushes, carriages, picture frames, etc., in variety too great to be here enumerated. Chair work of the most elaborate style is easily done where hand-work has heretofore been used.

A recent and valuable adaptation of the vertical cutters is for the production of dovetails of great strength and accuracy. The squared pieces being placed at right angles in a guide frame, a cutter, against which they are brought by a lever, mills out the mortise from one side, and cuts a tenon of precisely the same angle and width, and of proper length, in the end of the corresponding piece, both at the same time. The guide or carriage is then moved laterally, so as to present the stuff to the cutter for the next mortise and tenon, the lateral motion being regulated absolutely by stop-catches. By this means a perfect and "honest" dovetail is produced. This machine is one of the specialties manufactured by the Battle Creek Machinery Co., of Battle Creek, Mich., U. S. A.

Paper Plates for Restaurants.

The latest application of paper is the adoption of paper plates by some of the great restaurants and cafés in Berlin. The innovation was first introduced during the summer of last year by the adventurous landlord of a much-frequented open-air restaurant. Every customer who ordered bread and butter, rolls, cakes, buns or similar articles, had them served to him upon a little paper plate, made of light papier-maché, adorned with a pretty border in relief, and having at the first glance a great similarity to porcelain. Guests, waiters and host were all pleased with the novelty; it saved the waiters many a deduction from their wages on account of breakages, which the deftest and cleverest can scarcely avoid when he handles hundreds of pieces of crockery during a single afternoon and evening. The paper plates were so cheap that the landlord did not care to assert his ownership over them, and his customers were allowed to carry them away, like the petty serviettes of thin paper used in so many restaur-

ants in Holland. There was also a considerable saving of the time lost and the chance of accident incurred in the cleansing of earthenware pottery. The success of the experiment has been so marked, that the new species of plates is likely to be introduced into a great number of restaurants.

Crystalene Paints.

We have before us samples of a variety of the preparations of the American Crystalene Co., of 87 Liberty street, New York. These comprise crystalene mixed house paints for outside work; the same for inside work; crystalene roof covering; paints adapted for machinery, bridge and iron work generally; crystalene marine paint for ships' bottoms; crystalene boiler paint, and dryers and cements.

The object of the makers of these paints has been to produce a material for protecting the surfaces of wood and metal with a coating that should possess extreme hardness, be indifferent to the action of the elements, and that should possess a beautiful and permanent glossy finish without the aid of varnishes, and colors that should be permanent. These paints have been before the public for several years, and have in that time acquired quite an extended reputation for the qualifications embraced in the foregoing claims. The characteristic materials employed in the preparation of these paints render them non-porous and non-absorbent. They are claimed on these accounts to effectually prevent the rusting of any metallic surfaces to which they may be applied. They are said also to be particularly good for checking the dampness of walls, and for marine purposes generally. These paints work freely under the brush, and the makers claim for them that they possess almost twice the covering properties of ordinary white lead paint, and that one gallon of the crystalene brand is equal to two of other mixed paints.

The brand known as "Royal White" is remarkable for its extreme whiteness, and is claimed to be very durable and not liable to change its color.

All delicate tints used for inside work for any purpose will remain without change of color for a great length of time. They are not affected by gases, smoke or disinfectants, and are said to be absolutely free from any poisonous ingredients. These colors are used for the finest ornamentation of walls, and may be cleaned by the use of water, hot or cold, or diluted acids, without injuring the finish. The so-called crystalene roof covering is an article of great toughness and durability. It will not crack, peel or wash off, and has superior covering qualities. It may be used over paper, felt, tar, tin, zinc, copper or any other roofing materials or paints.

These paints are particularly well adapted for use upon iron-work, such as bridges, railings and other exposed structures, where the hard surface they present, their tenacity and indifference to atmospheric influences, make them specially valuable. For the same reasons, they are excellent for iron castings and machinery of all kinds. For the last named uses the makers claim peculiar merits for their products.

The manufacturers also prepare a brand known as "Crystalene Marine Paints," ready for use. They will dry in a short time, with a rich gloss, can be used in any weather, and are of any color. Water has only the effect to harden them, and they are admirably adapted for ship bottoms, buoys and all submarine surfaces, hulls, yards, etc. A crystalene boiler paint made by the same company, will stand, according to their claim, from three hundred to five hundred degrees of heat, and may be used with great advantage for the covering of boilers, smoke stacks, and all heated surfaces.

Among the products of this company is an article known to the trade as "Crystalene Cement." This cement is described as possessing the following properties—namely, it resists a considerable degree of heat, steam or hot air, and becomes exceedingly hard; when it is desired to break a joint, it leaves the thread perfectly clean; it resists the action not only of water, but of petroleum, naphtha, turpentine, or any other known solvent; it is inexpensive, and is applied like all other cements.

Further particulars respecting the mode of applying and using these goods, together with samples of the same, may be had on application to the company at the address given above.

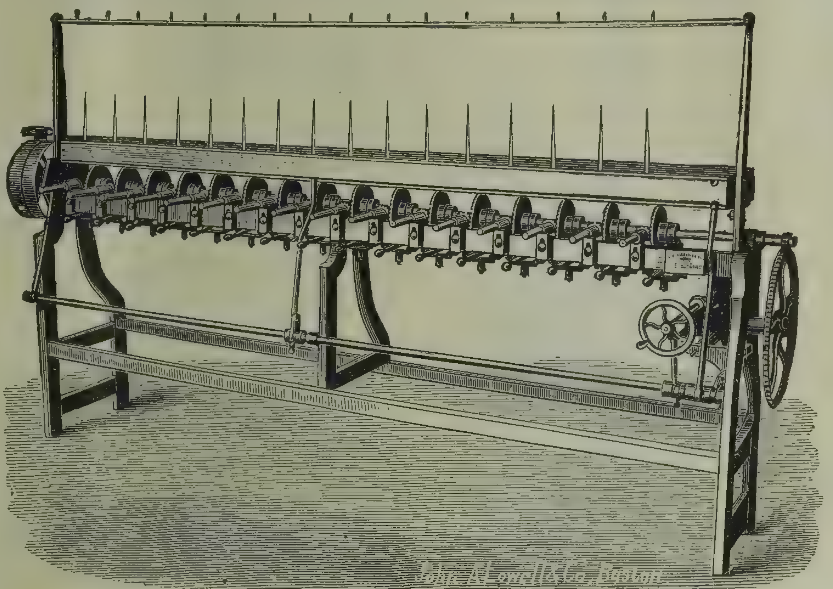


Fig. 1.—Improved Cop-Winder.

A New Substitute for Stone.—An iron company in England is introducing the use of concrete slag for building purposes by the force of example. Its new offices near Leeds have all the door and window facings and the ornamental work—usually of stone—made of this hitherto waste material. There is quite a display of imitation carved bricks, in various colors, made of the slag, the cost of which is said to be fifty per cent less than the real article of clay, which hitherto has been so much in fashion.

Fig. 2.—Improved Furnace Grate-Bar.

The company also supplies the Midland and Northeastern railroad companies with slag concrete flags, ready for use in the laying down of platforms at railroad stations.

Specialties of the Salem Foundry and Machine Shop.

The above-named establishment, located at Salem, Mass., is engaged in the manufacture of a number of mechanical specialties, including, among other things, improved cop-winders for hosiery, cotton and woolen mills, improved tan presses, elevators with automatic hatchways, improved grate bars, etc. The concern has an interesting exhibit of its productions at the fair of the New England Manufacturers' and Mechanics' Institute, now in progress at Boston, from which we make the following description of the more important of their specialties.

Of these, the most interesting is the improved cop-winder, which is exhibited at the fair in operation, and of which we append an illustration in Fig. 1. A cop-winder, it may be explained for the benefit of the uninitiated, is a special machine employed in the textile industry. A "cop" is the conical ball of yarn or thread as it is taken from the spinning frame. This ball is placed on one of the upright projecting points shown in the cut, and the work of the machine is to wind it on a bobbin preparatory to knitting or waping. The bobbin is placed on one of the spindles, which will be observed at the front of the machine, and the spindle is connected to the shaft and set in motion by means of a lever, by which a beveled gear connected with each spindle is caused to engage. Each of the spindles is independent, and can be independently engaged and disengaged with the greatest ease.

The old form of cop-winder had a drum at the lower part of the machine, which was connected with the spindles by means of belts or bands. The old machine is a cumbrous affair when compared with the simple and mechanical construction of the one here described. In referring to this improved machine, the makers call special attention to the advantage derived from having the spindles run by bevel gears instead of by belts and pulleys, by which they entirely avoid the loss of motion involved in the slipping of belts and bands. This arrangement of the machine, therefore, implies a considerable saving of power. The improved machine, furthermore, is very durable, requiring little attention for repairs. It can be run at high speed, thus insuring a greater product, and at a lower cost per spindle, than can be accomplished with the use of the old form of machine.

The same establishment likewise exhibits an improved tan press. The waste or spent tan has of late become an important article of fuel with the tanners, and the purpose of the press is to extract the liquor from the leached material, and thus expeditiously prepare it for use as fuel, while formerly the material was simply spread out in the sun to dry.

The tan press made by these manufacturers is a simple and compact apparatus, requiring less than half a horse-power to run it, and furnishes the tanneries with a most desirable labor-saving machine. In pressing for fuel, it places the tan in better condition for combustion than can be obtained in any other way. As produced from the press, the tan can be burned without assistance from any other fuel, and without the aid of a blower or other artificial draft. The press dispenses entirely with the labor of spreading and storing the waste material; it will press from five to ten cords per day, as may be desired. These presses are shipped ready for use, and the expense for setting is trifling. They have met with great favor in the tanneries, quite a number of them being in use with the most satisfactory results.

Another specialty exhibited by the same establishment is an improved furnace grate-bar, for steamships, locomotives and stationary boilers. This device is shown in Fig. 2. The advantage claimed for this bar over others, is the fact that it has a stout center web, so arranged as not to come in contact with the fire, thereby keeping it comparatively cool and preventing the bar from warping and bucking. The combination of the center web and cross sections of this grate bar is such that a better supply of air is obtained, and more frequent combustion insured, thus reducing the cost, as less fuel is required to obtain the same amount of steam.

At the present time, the proprietor of the Salem Foundry and Machine-Shop is personally in charge of the exhibit of his establishment. The local address of the works is corner Liberty and Derby streets, Salem, Mass.

Improved Hoisting Apparatus.

The necessities of business have rendered the use of hoisting apparatus for the safe and expeditious transfer of goods, merchandize and machinery from the lower to the upper stories of factories, stores, and the like, and their expeditious removal from place to place, in warehouses, in loading and unloading vessels, in building operations, and in a thousand and one other situations, absolutely indispensable. The circumstances have called forth a great number of highly ingenious mechanical devices, which demonstrate perhaps better than any other class of machinery some of the most important mechanical principles, and illustrate in the most striking and effective way to the eye of the beholder the advantages to be derived from the interposition of a machine between the hand of the workman and the work he wishes to accomplish. Nothing is more surprising to the mind untaught in mechanical principles than to witness the ease with which one or several workmen, with the aid of a few ropes and pulleys, or of chains and a train of gear wheels, will raise, lower and transfer from one locality to another, burdens that would tax the unassisted strength of dozens of men. Yet few of the thousands who daily witness such operations, stop to investigate the principles underlying this apparent multiplication of power, which remains a subject of surprise and wonderment each time it is observed anew.

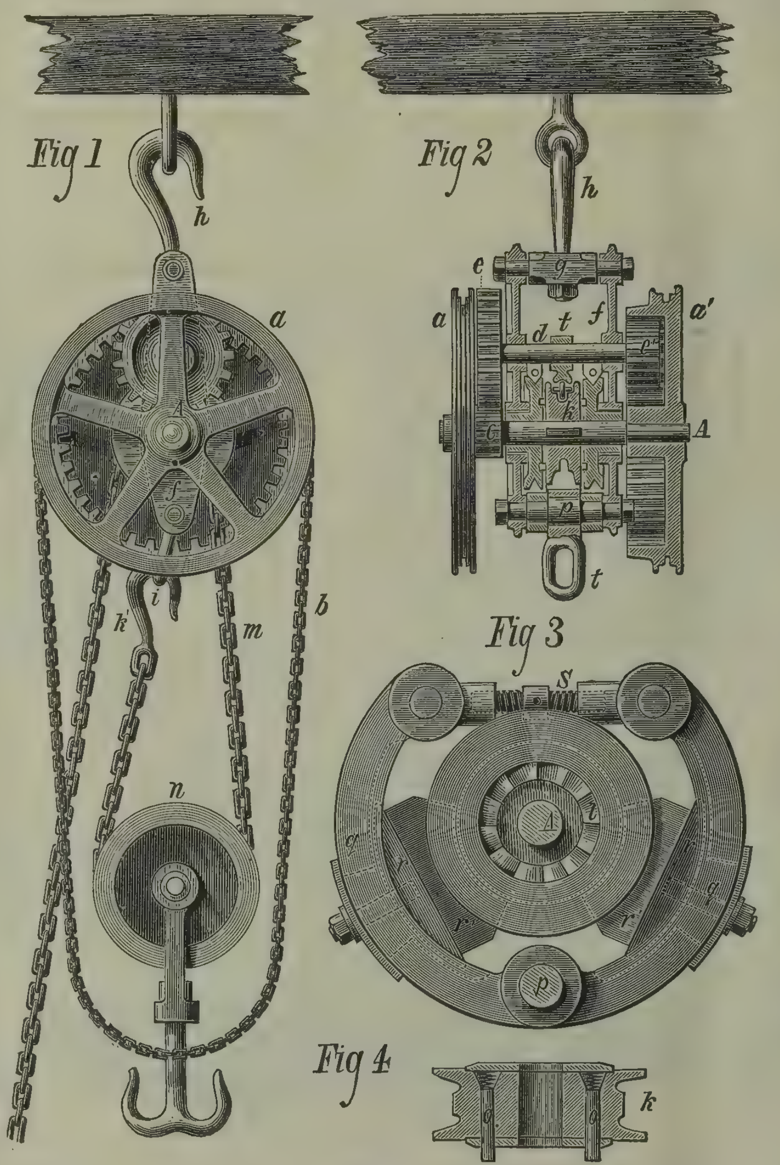
In the particular cases named in this article, the apparent paradox of the multiplication of power by the interposition of a lifeless machine, is readily explained. No machine, however ingenious its construction, can create force, nor can it exert any more force than is transmitted to it from the source of power; and every machine is provided with certain fixed points, which are arranged to support any required portion of the weight, while the remainder of the weight, and only that part, is directly sustained by the power applied from without. It is obvious, therefore, that this remainder cannot be greater than the power. But if the weight is not only to be supported, but must be raised through a given space, then the power must move through a space as much greater than the weight moves through as the weight is greater than the power; in other words, the power and weight must bear an inverse proportion to their respective velocities. We express this inverse proportion in common terms when we say of a machine that it gains power at the expense of time. This principle of mechanics expresses the important relation of power to speed, which is especially obvious in the class of machinery of which we shall describe an important example further on.

To further illustrate this principle, we may add that to raise 1,000 pounds 1 foot high by a single effort, would require a force of 1,000 pounds; but the same thing could be accomplished by a power of 1 pound acting for 1,000 times successively through the space of 1 foot. If a man, by exerting his entire strength, could lift 200 pounds to a certain hight in 1 minute, no machine can be devised to enable him to lift 2,000 pounds to the same hight in the same time. But by dividing the weight into ten parts, he may lift each part separately, or by interposing a machine which shall support any required portion of the weight, he may raise the whole mass together, requiring, however, 10 minutes for the task.

It will thus be seen that power and speed sustain an inverse ratio to each other. A man with one machine may lift 1,000 pounds 10 feet high in 1 minute, and with another machine, differently arranged or geared, may lift 100 pounds 100 feet high in the same time. In each case, however, the work accomplished is the same, and is expressed mechanically by multiplying the weight by the number of feet it is lifted in one minute, the result being designated as "foot-pounds." In each of the above supposed cases, the work accomplished amounts to 10,000 foot-pounds.

A hoisting machine—and with this class of machines we are here specially interested—can be proportioned with any ratio of gearing desired. If wanted to hoist rapidly, it is obvious that only a small load can be lifted; if, on the contrary, it is required to lift a heavy load, the load can only be lifted very slowly; and in proportioning such machines, the makers invariably endeavor to employ such a ratio of gearing in each machine that it shall lift the maximum load for which it is intended, at the quickest rate of speed which is possible with the number of men employed to operate it. In all cases, however, the fundamental principle should never be lost sight of—that every gain of speed is invariably accompanied by a loss of power, and *vice versa*, every gain of power accompanied by a corresponding loss of speed, without an increase in the amount of power applied to the machine to simultaneously increase both power and speed.

These preliminary considerations will enable our non-mechanical readers to comprehend the theory of the operation of the class of hoisting apparatus of which an illustration and explanation are here given. The apparatus in question represents an improved form of hoisting machine for lifting variable loads, and embodies the desirable qualities of safety, portability and efficiency. Its construction and operation are as follows: The invention consists in a block provided with differential gearing of novel construction, provided with a safety stop device and automatic brake acting by the weight of the load. In the engraving Fig. 1 is a side elevation of the apparatus; Fig. 2 is a central vertical section; Fig. 3 is a vertical section showing the brake mechanism; and Fig. 4 is a detail view of the chain wheel.



IMPROVED HOISTING APPARATUS.

The load is raised or lowered by operation of either hand chain, according to the power required. The chain on the wheel *a'* gives the greater speed, and with heavy loads may be first used to tighten the hoisting chain, and the other hand chain then used. As the chain wheel *k* turns in raising the load, its pawls engage the ratchets of wheels *l*. The load on shaft A is sustained by brake wheels *l*, resting on blocks *r'*, which, in turn, are supported by bar *p*, so that the brake is continuously applied and the chain wheels arrested by the ratchet devices the moment the hand chains are left free. In lowering the load, the hand chains are to be run backward, and the chain wheel *k* will then give revolution to the wheels *l*. The load will thus be at all times under the control of the operator.

It will be seen that with this apparatus four rates of speed are attainable. The apparatus is also safe and portable, and can be made of comparatively small size and used for heavy loads. The brake wheels have sufficient holding power, though made of small size, for the reason that the whole load, resting on the axle, is taken by the brake blocks at opposite sides of the wheels. The resistance can be varied by shifting the blocks to change the angle of resistance.

In this apparatus the friction is reduced to a minimum, since the load is raised only by differential gearing. Every load, light or heavy, can be lowered with the fast speed, consequently a large amount of power and time can be saved; it is, therefore, a most economical hoisting apparatus.

This invention was recently patented by J. George Speidel, of 933 Buttonwood street, Reading, Pa.

The inventor calls special attention to the fact that the automatic safety brake referred to in connection with the above description, can be employed for all kinds of hoisting machinery. For terms respecting the use of the patent right, address the patentee as above.

Wire Belting.

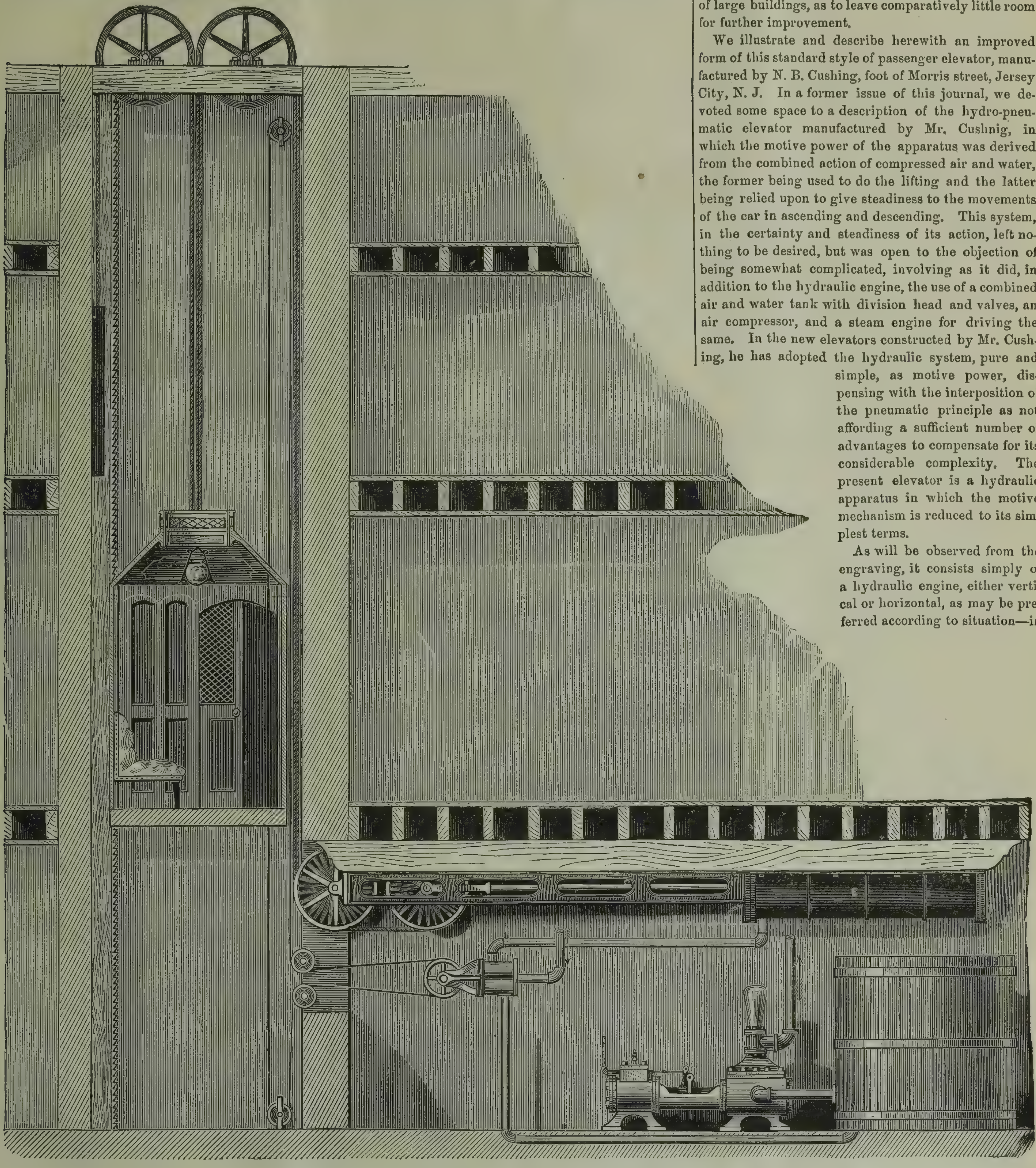
Herr J. Jarolinek has brought out a novel kind of wire belting. The wire is wound on spindles, the diameter of which is as small as practicable, and is obtained, therefore, in the form of a long spring. *Der Techniker* states that the main point to be observed in using these wire coils, is to give them dimensions proportioned to the power to be transmitted, so that while flexible they do not suffer undue elongation when in use. Practical trials have proved that the proper proportion between tenacity and elasticity of these coiled wire springs is obtained when the spindle, around which it had been wound, has a diameter equal to that of the wire. The two ends of a string are hooked together, and each string—the number varying according to the power transmitted—is laid on a groove on the pulleys. This method of transmission is reported to be cheap and effective.

Cushing's Improved Hydraulic Elevators.

The constantly increasing demand for elevators for passenger service has had the effect of directing special attention on the part of makers to the improvement of this class of machinery. In this task they have succeeded remarkably well, and the best forms of passenger elevators made to-day, realize to a high degree the severe requirements of safety, certainty and economy in operation. The improvements, in fact, in this class of machinery have fully kept pace with this constantly growing introduction, which is rapidly coming to be almost universal. As above remarked, the requirements of passenger service must be credited with having given the incentive for these improvements, and for this service the elevator has become absolutely indispensable. The first passenger elevators were simply improvements upon the old freight cages; but their liability to accidents did not recommend them specially to public favor. In time, safety appliances in the form of extra supporting ropes, clutches, etc., were provided, which, by doing away with many of the objections to this class of machinery, fairly inaugurated the era of passenger elevators, until to-day no large building is considered to be completely furnished without one or more of these indispensable conveniences. The objections to the use of steam as the motive power of elevators, was in time overcome by the adoption of the hydraulic system; and the improved hydraulic elevator of to-day so fully meets the needs of a safe, speedy and smoothly operating means of ascent and descent to and from the elevated stories of large buildings, as to leave comparatively little room for further improvement.

We illustrate and describe herewith an improved form of this standard style of passenger elevator, manufactured by N. B. Cushing, foot of Morris street, Jersey City, N. J. In a former issue of this journal, we devoted some space to a description of the hydro-pneumatic elevator manufactured by Mr. Cushnig, in which the motive power of the apparatus was derived from the combined action of compressed air and water, the former being used to do the lifting and the latter being relied upon to give steadiness to the movements of the car in ascending and descending. This system, in the certainty and steadiness of its action, left nothing to be desired, but was open to the objection of being somewhat complicated, involving as it did, in addition to the hydraulic engine, the use of a combined air and water tank with division head and valves, an air compressor, and a steam engine for driving the same. In the new elevators constructed by Mr. Cushing, he has adopted the hydraulic system, pure and simple, as motive power, dispensing with the interposition of the pneumatic principle as not affording a sufficient number of advantages to compensate for its considerable complexity. The present elevator is a hydraulic apparatus in which the motive mechanism is reduced to its simplest terms.

As will be observed from the engraving, it consists simply of a hydraulic engine, either vertical or horizontal, as may be preferred according to situation—in this case a horizontal cylinder, provided with a piston of proper diameter and stroke for the work to be done, a frame supporting the sheaves and guides for the traveling head, the whole securely bolted to the under side of the floor in the basement. In addition there is provided a simple valve mechanism, operated from the wire rope passing through the car, by which water is



CUSHING'S IMPROVED HYDRAULIC PASSENGER ELEVATOR.

alternately admitted to the cylinder or allowed to flow out of it as the car is required to ascend or descend; a water tank at the top of the building, another in the basement, as shown in cut, and, where the city water supply cannot be relied on for a sufficient supply, or where for economic reasons it is expedient to use it, a pump for forcing the water from the lower tank to the upper one, so that the same water may be used over and over.

The convenience and economy of this system of operating elevators have repeatedly been set forth in these pages, and require therefore no special rehearsal in this place. The carriage is suspended from a number of wire ropes passing over fixed pulleys placed above the highest point of the lift, and from those about the sheaves connected with the piston rod of the hydraulic engine. In addition to this, there is also a weighted block suspended from one of the overhead pulleys, which, with the resistance of the piston of the hydraulic engine, constitutes a counterpoise for the car. The additional safety appliances adopted in connection with the car, are as follows: The guide posts for the car extend throughout the whole hight of the building, from the cellar to the roof, and are faced with safety ratchets, between which the safety car platform is raised and lowered by means of the two wire lifting ropes which are connected with the hydraulic engine. The car platform is fitted with safety locking pawls, combined with a powerful steel spring, and the simplest possible device for forcing the safety pawls into contact with the safety ratchets should the lifting ropes break. These have been used for many years, have proved perfectly reliable, and can be depended upon to reduce the fall possible to the car to the length of the ratchet tooth.

Besides the ordinary safety pawls attached to the lifting ropes, there is an extra set of patent safety pawls underneath the platform of the car, which are operated by a separate wire safety rope; this rope is a safety device entirely disconnected from any of the other working parts of the apparatus, and extends from the top to the bottom of the hoistway, running over pulleys at the top and bottom, and both ends are connected to the lever which operates the safety pawls under the car. The safety rope travels with and at the same speed as the car. In the upper part of the hoistway the rope passes over pulleys which give motion to a safety hammer or brake. When the car is running at its ordinary speed, the safety hammer does not act; but as soon as the speed is accelerated beyond what it should be, balls fly out and strike a catch-plate, the brake is dropped, and the motion of the safety rope ceases, while the motion of the car is continued far enough to throw the safety pawls or dogs into the safety ratchets, and the car stops instantly. In addition to the above-mentioned safety devices, there is also an automatic stop upon the hydraulic engine, so that if the check rope should break and the operator lose control of the car, the engine will stop itself when the car arrives at the top or bottom of its run.

These elevators are claimed by their maker to combine all the advantages in point of safety, ease and smoothness of operation, simplicity, and non-liability to derangement which characterize any hydraulic elevators now in the market. Further particulars respecting them, which our limited space compel us to omit, will be supplied by the manufacturer at the address given above.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

New York City Building Items.

A home for respectable aged and indigent females is to be located on the southeast corner of Tenth avenue and One Hundred and Fourth street, and is to be 134 feet front by 90 feet deep, and to cost $100,000. The structure is to be four stories high, and the front of brown stone. The Association for the Relief of Respectable Indigent Females (Eliza M. Morgan, Directress) are the owners.

On One Hundred and Twenty-sixth street, near Third avenue, I. E. Wright is going to build an apartment house, 30 by 86 feet, five stories high, and of brick with stone trimmings, from designs by Thom & Wilson. The cost will be $20,000.

Two dwellings are to be erected on the west side of Madison avenue, near Sixty-first street, to cost $110,000. The dimensions of each are to be 29 feet front by 73 feet 4 inches deep, and four stories high, the frontage to be of brown stone. Henry G. Marquand is the owner.

Plans have been filed in the Bureau of Buildings for the erection of a club house for the Liederkranz Society. The building is to be located at Nos. 111, 113, 115, 117 and 119 East Fifty-eighth street, to be three stories high, 125 feet front by 98 feet deep, and to cost $100,000. The front is to be of brick and sandstone.

Workmen are now engaged in making a valuable addition to the Cooper Institute. Mr. Cooper some time ago struck upon a plan by which more space could be utilized for the eager seekers after knowledge who crowd the building that he has dedicated to free education. Not satisfied with his latest addition, which was the placing of an additional story upon the original building, he resolved to delve underground, and thereby gain more room for the purposes for which the institute was founded. The flat, iron-shaped block bounded by Third and Fourth avenues, Eighth street, and the point where the Bowery merges into the two avenues, was all originally the property of Mr. Cooper. When he erected the edifice on the upper end of the lot for the use of the Institute and Free Library, he ceded the rest of the lot to the city, on the condition that they should convert it into a park. The south end of the Institute building was on the line of Seventh street. The city accepted the gift, and ran Seventh street through from Third to Fourth avenue, and on the other portion of the lot planted a few trees and bushes, and enclosed it with an iron railing. The street has been excavated from Third to Fourth avenue to a depth of 18 feet. Then brick arches, supported on iron columns, have been built the whole length from curb to curb. This gives an underground arched room 81 feet long by 28 feet wide. The work is now nearly completed, and after all the arches are turned, the streetway will be relaid. The room thus laid is to be used as a class-room for students in practical machinery. It will contain three engines and boilers that are to heat the Institute buildings, and machinery of all kinds to be used in instructing the pupils.

Miscellaneous.

The Chicago, Burlington & Quincy Railroad Co. are to erect in Chicago, Ill., a six-story brick office building, 128 by 180 feet, on Adams and Franklin streets. The cost is to be $300,000.

The Roman Catholic Church of St. Agnes is erecting a structure at the corner of Hoyt and Sackett streets, South Brooklyn, N. Y. The edifice is to be an elegant structure of brick, with brown stone trimmings. It will be 80 feet front by 140 feet deep, with an imposing tower 200 feet in hight, and will be a handsome ornament to that section of Brooklyn.

The towers of the new elevator built by David Dows & Co. at the foot of Pacific street, Brooklyn, N. Y., may be seen with a spyglass from Sandy Hook. This monster building, which is said to be the largest elevator in the country, and probably the largest in the world, is now being completed, although it was put in use several months ago. It has 100 feet front upon Columbia street, and extends 1,200 feet to the river, 600 feet being occupied by the main building, which is of brick, and 600 feet by a frame extension, which is sheathed with tin. The frame building is 45 feet high, and has a tower in its center 100 feet high from the wharf level. The brick building is 85 feet high, and has an elevator tower in the northeast portion 120 feet high. Three towers rise from the center line of the main building about 100 feet from each other. Each tower is 175 feet high. It required 17,000 piles, 25 feet long, to form a foundation for the massive building, as the soil permitted no other foundation. The piles were covered with heavy timber, upon which a stone foundation 3 feet thick was laid, and above this rises a solid brick wall. The jar of the machinery, which is a constant menace to all great buildings, is broken by heavy bracing beams 2½ feet square, extending from floor to floor, starting upon a solid base of stone laid over 16 piles sunk close together. Solid brick walls divide the main building into nine apartments, closed to each other except where there are openings for the belting to pass through. These walls form a bulwark against fire, as the holes can be closed by dropping a cast-iron door over them; and if the fire should be so fierce as to cut off access to these doors, they are so arranged that the ropes may be burned quickly, thus permitting them to drop of their own weight. An electric fire and burglar alarm is furnished for the building. The machinery in the elevator can take grain at the rate of 8,000 bushels an hour from the barges or vessels at the pier. The grain is elevated, sifted and fanned, weighed, stored, put in bins, and then transferred to vessels at the pier. There is nearly a mile of wire cable used to transfer the steam power, and about five miles of belting, called "conveyers," carry the grain up with railroad speed. These conveyers travel at the rate of 600 feet a minute, and carry to its destination 2½ bushels of grain a minute. No shoveling is necessary.

The rebuilt factory of the Ansonia Clock Company in Brooklyn, N. Y., consists of two large and two small buildings. The entrance is on Eighth avenue, and the works extend from Twelfth to Thirteenth streets, and nearly to Ninth avenue. The largest building is the one fronting on Seventh avenue. It is perfectly square, being 200 feet on each side, and four stories in hight. It is built of brick, and the mason-work is very solid, the walls being about 2 feet thick. The new building stands exactly upon the site of the one that was burned, but it is only four stories in hight, whereas the other factory had five. Fastened to the factory walls, inside the yard, are iron stairways and galleries, broad and substantial, leading to every floor upon each of the four sides of the building, so that if a fire occurred the factory could be emptied within three minutes. Iron shutters have been hung for all the windows, and very costly and complete precautions have been taken to guard against another fire. Upon each floor of the new building—that is, each floor on each side of the factory—there are two lengths of hose, each 100 feet long, which are all the time in position, and can be used at a quarter of a minute's notice. Besides these, there are throughout the different buildings 1,500 automatic sprinklers worked upon the thermostatic principle—that is, if the temperature in any one place gets above a certain degree of heat, the expansion and contraction of certain metals at once start the thermostatic machine, and the water is thus automatically released. These are designed for action in case a fire should break out at night when there is no one present to handle the hose; and there are so many of them, and the pressure of the water would be so great, that it would be almost an impossibility for a fire to get any sort of a headway. In addition to these precautions, the factory is covered by a large number of electric alarms as well, which, when started, not only give the location of the fire and send an alarm to the office, sounding it upon a gong, but also sets the sprinklers in motion on whatever floor it may be started in. The wood finishing building is in the rear of the larger factory. It is also of brick and built in the same style as the one described. It is five stories in hight and 200 feet in length by 50 in breadth. There is an immense amount of delicate wood-work to be used, and it will be in this building where it will be manufactured and prepared. Then between these two large buildings is the finishing and varnishing shop, a three-story building 80 by 50 feet in size, and the foundry building, which is only one story in hight. The wood-finishing, varnishing and foundry buildings are all new, and form a large addition to the building as it formerly existed

Prescott's Sliding-Door Hangers.

Sliding doors in the abstract, are among the greatest conveniences that we have, because they afford full and free opening, and may be made of any desired size. In the concrete, as we have them generally constructed, they are a heavy, clumsy, expensive and noisy nuisance. Properly applied, these hangers serve equally well in a palace, a barn, or a freight-car.

The device here shown seems to be one of the few rational methods yet devised for hanging sliding doors, doing away with the necessity of having rolls or tracks, and coming into play for warehouses, factories, freight stations, sheds or stables, as well as for parlors, box freight-cars, elevators, steamboats, etc. One class of these hangers is intended for use for doors where there are double partitions, as is generally the case where there are two parlors. In this case the hanger is fastened to the back edge of the door, as will be seen by reference to Fig. 1. When the door is open, the hanger is crossed at one side of the door, between the door and the wall to which the hanger is connected. When, however, the door is closed, the hanger (still hid from view) stands perpendicular behind the jamb casing. Being balanced, heavy hard wood or thick pine doors, may be run in or out with great facility. There is no track required above or below, and as in operation the door rises, there is considerable saving of wear of carpets.

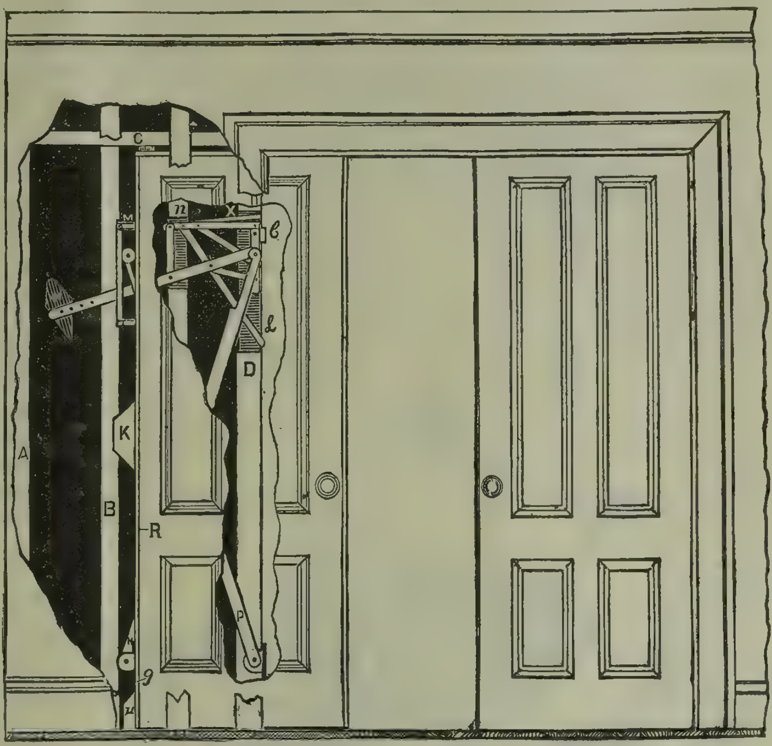


Fig. 1.—The Balance Hanger.

In Fig. 2 is shown a brace hanger for public buildings, cars, etc., particularly where there are tall, narrow doors, not over 3½ feet wide. The horizontal distance that this door can be moved is about three-fifths the length of the hanger, which should be about 4 to 5 inches less than the hight of the door.

These hangers are made right-handed for right-handed doors, and left-handed for those which slide to the left.

One of the principal advantages of these hangers is that they can be applied at any time after the house has been all studded and plastered.

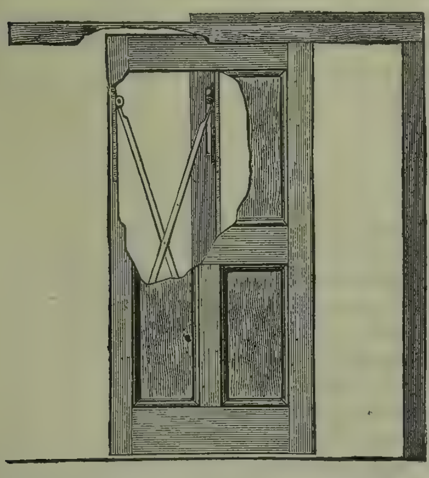


Fig. 2.—Brace Hanger, with Portion of Door Cut away to Show its Position when the Door is Half Open.

Brace and balance hangers are being very extensively introduced into new residences in New York, Boston, and wherever they have become known, the remarkable convenience attending their use leading in many instances to the substitution of this arrangement for swinging doors, especially in closets, effecting a great saving in room.

The truss hanger, illustrated in Fig. 3, was patented about three years ago, and has been quietly gaining in public favor until it has become known, by reference of one party to another here and there, all over the country. Invented on a farm, and applied chiefly at first on barn doors, it has since been found infinitely superior to any device known for sliding doors of factories, sheds, warehouses, etc. Single doors of all sizes up to 15 feet in width are moved with the greatest ease.

Evidently the true principle of motion for sliding doors is covered by this unique invention, and we are much pleased to extend a knowledge of its great practical value. Full particulars can be obtained by addressing the Prescott Manufacturing Co., 235 Washington street, Boston.

Weight of Cars and Car Wheels.—An empty platform car weighs 18,000 pounds; an empty box car, 20,000 pounds; a passenger car, 36,000 pounds, and sometimes more; and an average locomotive, 80,000 pounds. A single pair of car wheels weighs 500 pounds.

Improved Method of Working Iridium.

Mr. John Holland, of Cincinnati, after many years of experimenting, claims to have devised what has hitherto been wanting, namely, a ready method of fusing and molding iridium. By reason of its extreme hardness and infusibility, this metal has hitherto been practically worthless, except that it could be alloyed and worked in small proportion with platinum, or used for pointing gold pens. For the last named purpose, however, it was found that many of the grains and scales of the metal were worthless, by reason of having cracks and fissures in them, in consequence of which much of the material was wasted. For Mr. Holland's purpose—*i. e.*, making drilled points for fountain pens—the difficulty of working and the loss of material from imperfect particles, and the wasteage from grinding, were considerable.

The experiments of Mr. Holland to overcome these objectionable qualities and features, resulted in his invention of a process for fusing and molding the metal, which adapted it excellently for his use, and for other useful purposes in the arts. His invention is covered by letters-patent dated May 10, 1881, from the text of which we abstract the following points of interest:

"By my invention I am enabled to fuse the dust as found in its natural state, whether pure or combined with other metals, into a molten mass, and mold the metal into ingots of any desired shape or size. I accomplish this result by the following process: The metal (preferably the dust, which, being of little use in the arts, is comparatively inexpensive) is put into a sand crucible and subjected to a high heat in an ordinary furnace. When it has attained a high temperature, I add to the metal about one-fourth its weight of phosphorus. After the addition of the phosphorus, the metal quickly fuses, when it may be poured into molds of any shape or size. I find it best to have the molds highly heated, as the metal chills and sets quickly. So soon as the metal is set, I place it in a crucible, with chalk or lime, return it into the furnace, and again subject it to a high heat. This eliminates the phosphorus, leaving the metal pure, hard and non-fusible, as in its natural state.

"I prepare the metal for my fountain pen points by casting it upon a flat metal plate, the surface of which is crossed by fine ribs resembling lattice or net work. I pour the molten metal on this plate, filling the interstices between and covering the ribs. The metal is thus cast in a thin sheet or plate, having one of its faces grooved the reverse of the ribs upon the mold. Through these grooves the plate is broken into small cubes the proper size, to be drilled and formed into fountain pen points. The same plan may be adopted with advantage in preparing journal bearings for watches, to be used in place of the jewels now commonly used. For pointing gold pens, I mold the metal into the form of wire or small rods. These I break into pieces of a size to make strong, substantial nibs. The metal may also be cut by using a copper wheel or disk and diamond dust.

"As the metal is exceedingly hard, non-fusible, practically non-corrosive, and capable of receiving a high polish, it will now be seen that I have discovered a mode of working it, supplying a great need long felt in many branches of the arts. The metal is made much tougher by eliminating the phosphorus, but it may be used for many purposes without so doing."

The Channel Tunnel.

While the papers are making mention of various gigantic canal and tunnel and bridge schemes, but little is said of the work which is quietly going on in tunneling the English Channel from Dover to Calais. The engineers in charge of the work are employing three shifts of men, each working eight hours, and boring is going on now at the rate of 30 feet per day. The shaft leading to the tunnel is 300 feet deep, and the boring already accomplished is about 500 feet. The distance between the two shores is about 22 miles, and at the present rate of boring it will take not less than 11 years to complete the tunnel.

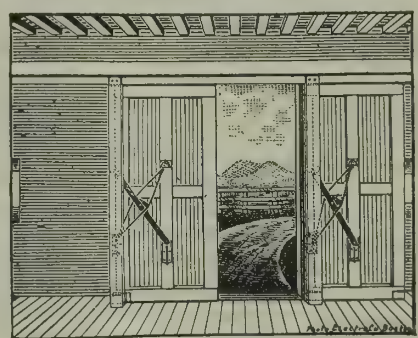


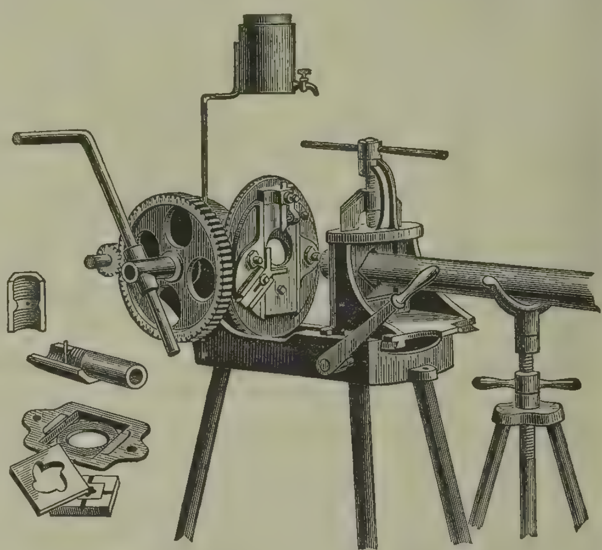
Fig. 3.—The Truss Hanger—Inside View.

A Cheap Paint is made for brick walls by simply mixing up good hydraulic cement in water, and applying with a whitewash brush. The natural tint is neutral and pleasing, but may readily be varied. This paint cannot be washed off by storms nor peeled off by the sun.

Chase's Pipe-Cutting and Threading Machine.

The adjoined cut represents a very effective and important tool, which is designed to fill a want long felt by steam and gas fitters and machinists for cutting and threading pipes rapidly and cheaply, and is an invention that enables the workman to perform with ease one o the most tedious and laborious operations in mechanics, and it does its work expeditiously and perfectly. It is capable of cutting chips in the same manner as a lathe, leaving the work smooth and perfect—no pipe-splitting, no bevel inside or outside. It will cut off and thread all sizes of pipe or round iron, from one-fourth to two inches inclusive; and it is claimed that an apprentice boy, with one of these machines, can do more work than two men with the old system. This machine is simple and ingenious in the highest degree, constructed on sound mechanical principles, and performs its work with the greatest ease and satisfaction. It is the only machine that has automatic cut-off and makes nipples, and is very strongly constructed, being made of cast steel, malleable and cast iron. All the gears are cut, all the parts are made so as to be interchangeable, and the machine can be worked by any appliable power. It is a most useful machine for steam-fitters, gas-fitters, machine-shops, boiler-makers, car-shops, steamers, sugar refineries, distilleries, and for all those who have occasion to cut and thread pipes and bolts and make nuts.

For further particulars, see advertisement in another part of this journal, and send for circulars.



Chase's Pipe-Cutting and Threading Machine.

The English Channel Tunnel.

The preliminary work upon this gigantic undertaking is being quietly pushed forward, and the results that have been obtained are of so favorable a nature as to fully vindicate the opinions of the engineers who first pronounced in favor of its feasibility. As we have hitherto devoted but little space to this ambitious project, it may interest our readers to give a brief summary of its history.

The project of constructing a submarine railway tunnel under the waters of the English Channel, to connect England and France, originated with the officials of the South-Eastern Railway Company, and after much discussion it was determined to make the necessary preliminary explorations and borings. A French company was also formed to coöperate with the projectors, and the necessary concessions from the two governments were obtained. These preliminary movements were taken in the year 1872. The first examinations resulted in the formation of the opinion that the best line for the proposed tunnel would be one from the neighborhood of Dover on the English side to a point near Calais on the French side, by adopting which, it was believed, the tunnel could be almost wholly excavated in the lower chalk—a dense, homogeneous deposit, lying at the depth of 500 feet below high-water mark on each shore. In establishing the basis for this opinion, an examination was made across the Channel, by dropping from a steamer a weighted instrument in 500 places, the apparatus running with great velocity to the bottom, and bringing up chalk where it was expected. The current is so strong along the proposed line that the bottom is washed quite clean, as the experiments conducted showed the absence of any deposit. From these examinations, there appeared every reason to believe that the chalk was continuous, and that it stretches beneath the sea uninterruptedly across the Channel, a conclusion that is in strict accordance with geological evidence.

The maximum depth of water along the proposed line of the tunnel nowhere exceeds 180 feet below high-water mark, being deepest at the center, and gradually diminishing towards the two shores. The engineers proposed to place the tunnel at such a depth that the thickness of the rock-bed above it would be nowhere less than 200 feet; and this depth, which would be ample for security, would permit the railway approaches to be formed with tolerably easy gradients. The danger to be apprehended was, of course, from the possible existence of fissures in the chalk, which might seriously add to the difficulty of the work by permitting the infiltration of water; or might, should they be numerous and profound, render absolutely impossible the construction of the tunnel. To test this all-important question, on which the feasibility of the tunnel project depended, it was decided by the company to sink one or more shafts on each side of the Channel, and to cut from these experimental galleries beneath the Channel for some distance, until the feasibility of the work was either established or disproved.

Since the year 1873 this work has been quietly progressing according to the programme announced, and considerable headway has been made. Everything thus far has turned out as favorably as the friends of the project could have wished; and most persons who have taken sufficient interest in the project to read the accounts of the preliminary work that has been done, have formed the opinion that the Channel tunnel is entirely practicable, and that the only obstacle that may render its completion impossible will be that of its cost, which, though it is admitted that it must be enormous, has never been even approximately estimated. This element may after all prove to be an insuperable objection; but, meantime, the preliminary work above referred to is quietly going on, as may be gleaned from the account presented to the recent meeting of the proprietors of the South-Eastern Railway, at which the following points relating to the work were presented by the chairman of the meeting:

The whole question, he said, divided itself into two parts. One was whether they could pass under the Channel through a stratum which was impervious to water. The second point was whether, by the aid of machinery, they could shorten very considerably the probable time of construction. What they had done was this: They had already sunk two shafts on this side the Channel; one at the Abbot's Cliff tunnel, and the other on this side of the Shakespeare Cliff tunnel. From the first of these shafts they had driven a gallery of from 800 to 900 yards, of a diameter of 7 feet, which had all been excavated by machinery. In one week recently, with that machinery—which was not perfect—they excavated 67 yards of lineal distance on the extension of that gallery. If that were the maximum speed each week, it meant about two miles of progress a year. Of course, as they worked from two ends, and as the distance was only 20 miles, practically speaking, it meant five years to complete a gallery 7 feet in diameter, as an experiment, under the whole length of the Channel.

As to the second shaft, at the Shakespeare Cliff, they had sunk that down to a depth of 155 feet. They had also bored from the bottom of the shaft to a further depth of 106 feet. They had found no trace whatever of water in the old gray chalk; there was a small quantity of water near the surface, but this is always expected. He therefore thought that solved the great questions of the speed at which they could go, and of the impermeability of the strata to the leakage of water.

On the other side of the Channel the French company had sunk two very important shafts, and they had found exactly the same result as had been ascertained on this side. As to the machinery, they were on the eve of concluding another arrangement with Captain English, Colonel Beaumont and M. Pigou, the proprietors of the machine with which they had been working. Under this new arrangement, they would pay merely for the use of the machine, and by means of it they would carry those experiments considerably further.

It had been arranged between the French and English committees that they should drive through a heading of a further length of one mile on each side. When these two miles were finished—and they certainly ought to be in six months—one tenth of the question was dealt with. If that were successful, he should, he thought, propose a further treaty with the French gentlemen, under which the remaining nine miles on each side would be done, and they would meet in the middle of the Channel. If that were successful, the whole question was practically settled.

Until the matter was proved, however, neither the French nor the British investor would be asked to embark capital in the undertaking. The South-Eastern shareholders were, as it were, the founders of the feast. They had taken all the risk, and they had authorized an expenditure of not more than $100,000 upon the affair. Now, a great deal of what they wanted to prove had been proved.

Niagara as a Motor.

Sir William Thomson, of the University of Glasgow, writes as follows to the London *Times:* "Four leading articles in the *Times* of yesterday, on the storage of electricity, allude to my having spoken of Niagara as the natural and proper chief motor of the whole North American continent. I value the allusion too much to let it pass without pointing out that the credit of originating the idea and teaching how it is to be practically realized by the electric transmissions of energy, is due to Mr. C. W. Siemens, who spoke first, I believe, on the subject, in his Presidential address to the Iron and Steel Institute in March, 1878. I myself spoke on the subject in support of Mr. Siemens' views at the Institution of Civil Engineers, a year later. In May, 1879, in answer to questions put to me by the Select Committee of the House of Commons on Electric Lighting, I gave an estimate of the quantity of copper conductor that would be suitable for the economic transmission of power by electricity to any stated distance, and, taking Niagara as an example, I pointed out that, under practically realizable conditions of intensity, a copper wire of half an inch diameter would suffice to take 26,250 horse-power from water wheels driven by the fall, and, losing only 20 per cent on the way, to yield 21,000 horse-power at a distance of 300 British statute miles, the prime cost of the copper amounting to $300,000, or less than $15 per horse-power actually yielded at the distant station."

A COLLECTION OF ROCK SPECIMENS, in duplicate samples of rough 4-inch cubes, from all the existing quarries, and of all probably useful building stones in the United States, is now being made for the U. S. National Museum in charge of Prof. Baird. These samples will be subjected to careful physical and chemical examination under the supervision of Dr. Hawes, a well-known expert in lithology. The work is already well under way, and when completed promises to afford valuable

information respecting the supply and character of our domestic rocks used for building and ornamental purposes.

Improvements in the Manufacture of Colored Brick and Terra-Cotta.

Our attention has lately been drawn to the products of the Clark Colored Brick and Terra-Cotta Company (Limited), of Glens Falls, N. Y., by reason of certain statements of leading engineers and architects vouching for their excellence and general superiority.

The above named company was only formed two years ago, and their wares in red and buff, consisting of plain and molded bricks and terra-cotta architectural wares, have already found an extended and growing introduction throughout the country—notably, however, in New York, New Orleans and St. Paul's, Minn.

The buff bricks, of which manufacture this company make a specialty, have been adopted in the new Post Office at Albany, N. Y.; in Columbia College, New York; Mr. A. A. Low's large building in Brooklyn; in the entire front of the Church of the Immaculate Conception at New Orleans; Christ Church, Danville, Pa.; in the buildings of the Northern Pacific Railroad Co., at St. Paul, Minn.; and many other notable buildings. Suitable materials having been discovered at the last-named place, the company above named have lately erected a large establishment there for the manufacture of white bricks, which is in full operation, and has already gained a notable reputation for its products. These bricks and other products are made under a patented process, invented by Mr. T. M. Clark, the managing director of the company. They are now engaged in the erection of a large building to enable them to execute orders all winter.

Mr. Clark was engaged in the manufacture of these wares by his patented process for some years in Ottawa, Canada, and during that time, in the face of a high duty and freight charges, shipped large quantities into this country. Having located several branches of his manufacture in the United States, Mr. Clark confidently claims that he is now able to compete even more successfully with our domestic manufacturers than hitherto. Mr. Clark has shown us a large number of testimonials from architects, engineers, and others who have used his products, which speak in very flattering terms of their good qualities, of their strength, resistance to discoloration and to the action of the weather. Among these are cordial endorsements from Thomas S. Scott, Chief Architect of the Department of Public Works of Canada, and from Walter Dickson, superintendent of the government building at Albany, N. Y., in addition to which are many certificates of approval from private architects and builders.

Safe Boiler Setting.

To the Editor of the Manufacturer and Builder:

Will you be kind enough to inform me through your journal how the "arch or hood" across the uptake of a boiler is constructed. I refer to those spoken of on page 83 of your April number for this year, as recommended by the Hartford Steam Boiler Inspection and Insurance Co. We have boilers similarly constructed and set, and would like to protect them in some way so as not to obstruct the draft.

S. G. Chase.

Union Pacific Railway Co., Rock Spring Mines, Rock Spring, W. T., May 8th, 1881.

Answer.—The reply to this inquiry has been delayed by several unavoidable accidents. Answering the same, we beg to advise our correspondent that his inquiry was referred to Mr. J. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Co., for the reason that we preferred that the information requested should come from first hands, the analysis and discussion of the explosion of the "Rolling-Mill Boiler" which we published, and in which the question of proper setting was mentioned, being from Mr. Allen's pen. Mr. Allen has politely sent us the subjoined reply, and several sketches from which we have had engravings made to properly illustrate the subject. Mr. Allen's letter is as follows:

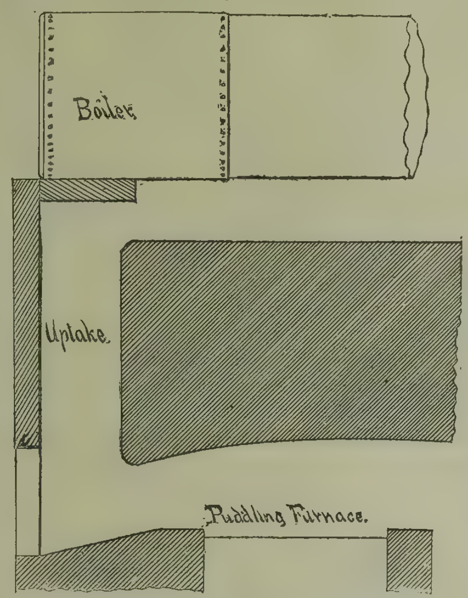


Fig. 1.—Longitudinal View of Boiler Improperly Set, Showing the Position of Protecting Arch.

To the Editor of the Manufacturer and Builder:

My delay in replying to you has been in getting the tracing ready. I had no sketch drawn. It was not

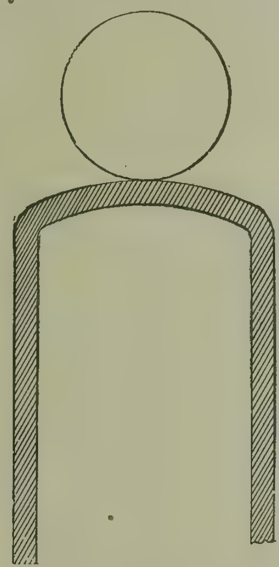


Fig. 2.—End View of Boiler Improperly Set.

uncommon formerly to so set the boiler that the end projected over the uptake of the furnace, so that the

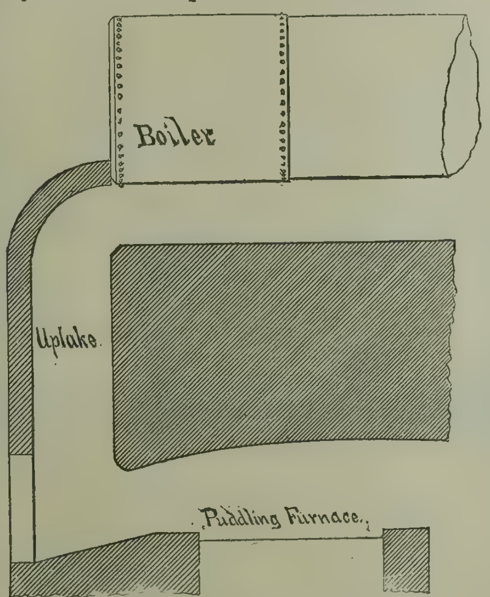


Fig. 3.—Section Showing Correct Setting.

heated gases ascended directly against the boiler bottom. Where boilers are set in that way, we build an arch under that portion of the boiler which is over the uptake. This prevents the flame from striking the boiler directly. The outer portion of the arch is built like a "hood" or the inner end of an old-fashioned brick oven, so as to turn the flame in a horizontal direction parallel with the boiler bottom.

Enclosed is a tracing as the boiler should be set.

J. M. Allen, *Pres't.*

The tracing referred to at the conclusion of the letter, is shown in Fig. 3, which is a section representing the correct mode of setting. The boiler is seen so positioned as to be protected from the direct action of the furnace gases, the flame ascending the uptake, striking a curved wall of masonry instead of the boiler bottom, and being deflected from this beneath the boiler.

The mode of setting criticised by Mr. Allen in his discussion of the causes of the "Rolling-Mill Boiler Explosion," published in our issue for April, is so obviously dangerous, as the direct impinging of the flame upon the exposed sheet cannot fail to dangerously overheat and weaken it, that no argument will be required to demonstrate the fact. Figs. 1 and 2, though not strictly correct, as they show the boiler resting entirely upon the brick arch, nevertheless suffice to illustrate the protective measure recommended by the Hartford company's inspectors, in cases where boilers are improperly and dangerously exposed over the uptake, as described.

Niter Deposits in the Far West.

Late accounts give information of the discovery of considerable deposits of niter in several localities in the Far West, the occurrence being not unlike those of Chili and Peru, which have proved of such vast commercial importance to those countries. It is sincerely to be hoped that these accounts have not been exaggerated, for should the existence of extensive deposits of this mineral be verified, there can be no doubt that they would become in the near future, so soon as facilities for transportation were provided, a source of wealth that might equal, if not surpass, in magnitude the production of precious metals which is at present the leading industry of those regions.

The enormous value of the South American niter deposits will be appreciated when it is stated that the yearly shipment of this product is not less than 500,000,000 pounds, the larger portion going to Europe, and the balance to the United States.

The mineral forms the basis of a number of important chemical industries. It is largely used for the preparation of sulphuric and nitric acids; for purifying caustic soda; for making chlorine in the manufacture of bleaching powders; for the preparation of arsenate of soda; in the curing of meat; in glass making; in the manufacture of red lead; in certain metallurgical operations in which crude iron is converted into steel; in the manufacture of saltpeter; in the preparation of artificial manures and composts, and for many other uses of minor importance.

From the foregoing, it will be comprehended that the existence of extensive deposits of this mineral would be a discovery of the very highest value. In Chili and Peru the niter beds yield an important revenue to the State; and so important are they, that the late war between those countries was caused by complications respecting the possession of certain deposits of niter.

Eelskins for Lacing Belts.—A manufacturer, writing to the *Blacksmith and Wheelwright*, says: "Eelskins make the best possible strings for lacing belts. One lace will outlast any belt, and will stand wear and hard usage where hooks or any other fastenings fail. Our mill being on the bank of the river, we keep a net set for eels, which, when wanted, are taken out in the morning and skinned, and the skins are stuck on a smooth board. When dry, we cut them in two strings, making the eelskin, in three hours from the time the fish is taken from the water, travel in a belt.

The Weakest Point.

Probably a little thought on this subject will lead to the conclusion that there is a weakest point in every fabric, and it is obvious the strength of this point is the true measure of the strength of the work to resist a steadily increasing and uniformly distributed force, such as fluid pressure, for example. If it were possible to construct a hollow sphere of absolutely uniform strength throughout, we should have the nearest thing to a boiler that has no weakest point. But such a vessel in this condition would be of no use as a steam generator, since the emission of the steam after it is generated, implies an opening in its wall, which, to be of no detriment to the uniformity of strength, must be exactly compensated for the loss of continuity by strengthening its borders—a problem requiring something more than a theoretical calculation to solve. It is plain that too much strengthening of the opening renders the uncut general area of the vessel the weakest, and the sphere will then break at any or all places other than at the opening. But, practically, there must be a point in the general surface that has some hidden defect, either of material or workmanship, that will determine the breaking point when the structure is uniformly overloaded. Again, the application of heat to this hypothetical boiler must be upon a less area than the whole surface, a portion being the wall of the steam-room, and so much of it would become overheated in that event. This would destroy the uniformity of its strength, if, indeed, it could ever have been made uniformly strong; and when its limit of strength is exceeded, it would inevitably break at this, its weakest point.

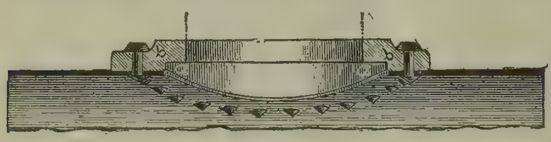


Fig. 1.

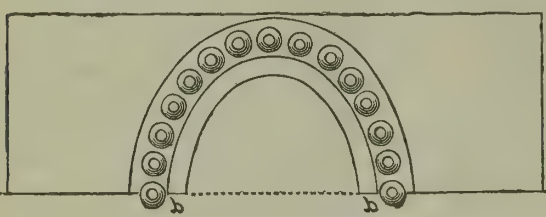


Fig. 2.—Half Top Plan.

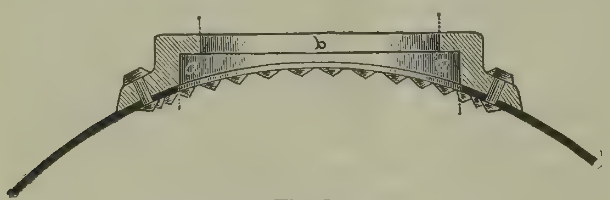


Fig. 3.

What is said above about strengthening, applies equally well to the practical steam boiler in its simplest and next strongest form—namely, the plain cylinder with hemispherical ends, although with equal distribution of material it is not uniformly strong in all its parts; neither is any other form that is not exactly spherical. But suppose it were possible to so distribute the material of a cylindrical boiler that the man-hole in the shell should be just equal in strength to the longitudinal seam, and the longitudinal seam exactly equal to the girth seam, or the head bracing and tube ends; still the disturbing effect of the application of heat to a part of the surface would be similar to the effect on the sphere, and however much we experiment on the cold boiler and reinforce its weak points one after another as they are developed, we have no positive assurance that the tensions are the same when heat is applied. It may be said in argument that since there must be a weakest point, it may as well be one point as another—the seam, the head or the man-hole, so long as either is recognized as the weak point, and known to have an ample margin of strength to resist a moderate excess of the working load. But we are never safe without the operative and ample safety valve. When once this organ, from any cause, ceases to work freely, we are, with an active generator, at once in the presence of imminent danger. The safety valve should all the time be the weakest point, and always kept at the limit of the working pressure. Much proper discussion has been had on the weakness of necks, man-holes and domes, and the fact implies that there is doubt even in the minds of those who advocate necks of considerable size, and domes as necessary adjuncts of the steam boiler; and the calculations relating to their strength are somewhat complicated, and may be, even with all the refined mathematics that is applicable, at least uncertain, without actual experiments of an expensive if not dangerous character; it is, therefore, safest to make them, beyond a peradventure, stronger than some other naturally weak point, which is an undoubted necessity in the construction of practical forms of generators. Necks and domes may be dispensed with in stationary practice; indeed, the question is an open one whether or not they are not an absolute detriment, aside from their doubtful character as to strength, particularly on stationary boilers that are not restricted as to size and weight, by considerations of space and of carrying capacity for dead weight, as is the case with railroad locomotive and marine boilers. In the absence of necks and domes of large size on plain cylinders, the next weaker of the absolutely necessary parts are the heads, man-holes, or the longitudinal seams; but since the first of these may be readily strengthened by proper inside bracing to the shell, or made hemispherical, and the second is only a question of a few pounds of cast iron properly distributed and attached, we need only consider the last, which, in the present state of the art of boiler-making, cannot be dispensed with without enhancing the cost to such an extent as to prohibit practically the use of welded joints or rolled ingot rings. But the calculations of the strength of well-made longitudinal seams in a plain cylinder boiler are comparatively simple, with material of known tensile strength and fairly uniform structure. The conclusion, therefore, is that domes and necks may be omitted, at least where strength is a matter of primary importance, and that the heads and man-hole being beyond doubt, we have a comparatively simple problem when the boiler is new; but it is now acknowledged by all well-informed steam users that deterioration must be intelligently watched, so as to preserve the preponderance of strength at the points named, while the safety valve must be constantly watched with scrupulous care, and kept weaker than any other known weakness.

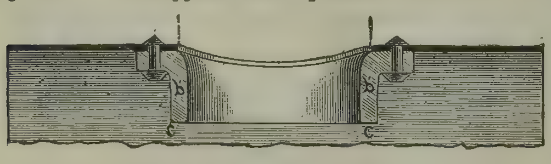


Fig. 4.

If this conclusion is a proper one, and drawn from sound principles, then a little time may be profitably spent in the study of the weak features of these weaker points, especially such of them as are apparently unavoidable in the construction of the simplest forms of steam generators. There will hardly be a difference of opinion among intelligent engineers as to the weakness of the man-hole in the cylinder, or as to its necessity somewhere in any boiler of considerable size. To admit the body of a man of average size, the least admissible dimensions of the clear opening are 11 x 15 inches, and the oval form, having less area than any other practical one that will admit a body of the size mentioned, has properly become by common practice the standard form of the opening in manhole frames. (Some are found as small as 10 x 14 inches, but they are not comfortable openings for a good-sized man with a suitable overdress). When they are placed in the cylindrical part of the boiler, it is with the long axis transverse to the axis of the cylinder, because less of the doubly-loaded metal is cut by so doing. The accompanying cuts, illustrating two distinct plans of oval man-hole frames, are here introduced for the purpose of studying their weak features. They may be designated respectively as the outside and the inside frames. Fig. 2 is a half top plan of the common outside frame of cast iron; Fig. 1 is a longitudinal section, as though cut by a vertical plane through its short axis, parallel to the axis of the cylinder; and Fig. 3 is a transverse vertical section through its long axis. The man-hole frame serves the double purpose of a seat for the covering plate and to compensate for the loss of continuity of material of the cylinder both longitudinally and transversely. The rabbet *a* (Figs. 1 and 2) forms the seat for the cover to rest against, the joint being made steam-tight by an annular strip of rubber, called the gasket.

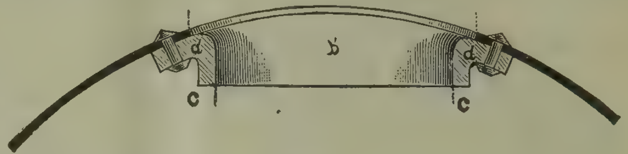


Fig. 5.

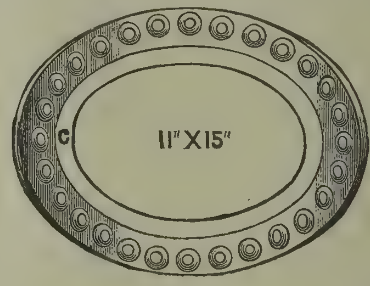


Fig. 6.

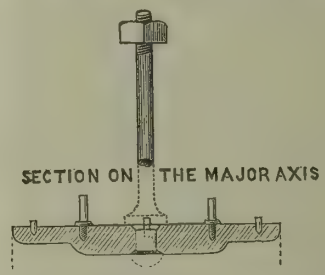


Fig. 7.—Plan for Inside Man-Hole Frame.

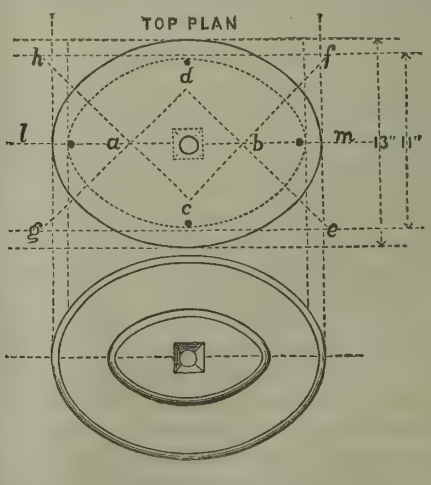


Fig. 8.—Bottom Plan.

It will be seen (Figs. 1 and 3) that the cover requires a larger opening in the shell than the opening in the frame which it closes. It seems plain, also, that the effect of an overload uniformly pressing outward upon

the seat *a*, when covered by the plate, would be to break this form of frame at its least section (*b*, Figs. 1 and 3), which is not only the weakest on account of its small sectional area, but it is the natural breaking point of an overloaded bar or girder of equal section throughout. To remedy this defect, increase of strength

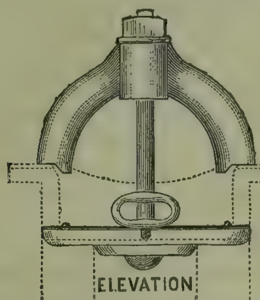


Fig. 9.—Arch and Plate for Inside Man-Hole Frame.

being considered for the time the primary object to be accomplished, the inside frame, shown in Figs. 4, 5 and 6, may be substituted in cylinders of such diameter that the inward projections do not so reduce the clear space below them as to interfere with the passage of a man's body for inspection or repairs. This inside plan of frame also recommends itself because less area of shell is cut away, as will be seen by comparing the two sets of cuts. Another incidental advantage of the inside frame is the facility with which the cover may be made to fit perfectly by planing both the seat and the cover, thereby avoiding the extraneous tension caused by forcing two uneven surfaces together by means of the bolt in making the joint steam-tight. Far less pressure is evidently required to make the joint tight—in fact, the office of the bolt may be considered simply to hold the cover firmly against the seat, the steam pressure against the plate completing the requirements. This latter plan of man-hole frame will be adopted for general steam boiler practice by the Hartford Steam Boiler Inspection and Insurance Co., and it is recommended, after practical tests and careful study, for all cases where there are no obstacles that prevent its use.

It will be seen that there would be but little advantage in planing the cover alone—in fact, if both surfaces had parallel distortions, planing one of them would increase the inequality, which must then be made good by a thicker and softer, hence a less reliable, gasket; therefore both surfaces should be planed.

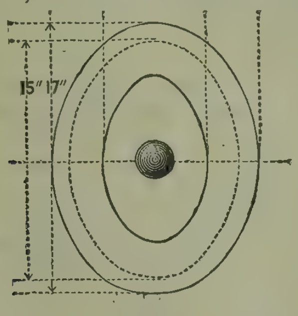


Fig. 10.—Bottom Plan.

The paramount advantage of the inside frame, however, is the one first mentioned—that its greatest section is opposed to, and admirably strengthens, the weakest section of the shell. But an important fact must not be lost sight of in this discussion, which is, in brief, no matter how you make the frame, if the curvature of both shell and frame do not coincide with the true curve due to the diameter, and if the riveters are careless, you will know after all but little about the strength of your device to resist steam pressure. This last proposition might be illustrated and enlarged on with interest, and perhaps with profit, to some thinking reader who has interests at stake, but space for this, or for the study of other weak points of the cylinder and heads, is not now available.

Referring again to the incidental advantage of inside man-hole frames, it will be seen on examination of Figs. 7, 8, 9 and 10, that the plate or cover, shown in section, elevation, top and bottom plans, has a plane surface for its entire top, which may readily be made true and smooth on the planer to fit the planed seat of the frame (shown in dotted lines, Fig. 9), which is the first step in the process of fitting, the bolt hole having been cored with a square "counter-sink" to receive the head or clinch of the bolt, as seen in section, Fig. 7, and in plan, Fig. 8. The object of the square cavity ("counter-sink") is to prevent the rotation of the bolt in the plate when unscrewing the nut, which tendency will be realized if the threaded point above the nut becomes corroded so as to make the nut run tightly. This is frequently the case in an aggravated degree with hand-hole plates in the smoke connections, as every engineer has experienced to his great annoyance. The bolt, therefore, should have no exposed thread outside of the nut on hand-hole bolts. After the plate is planed, the holes may be drilled and tapped for the two handles and the four gasket guide-pins, Figs. 7, 8 and 9. The collar of the bolt should be turned on its lower face and threaded for a square nut of good thickness, running freely on the bolt. The bolt end being

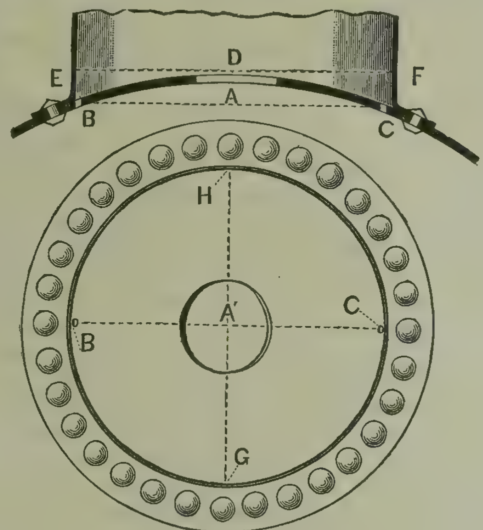


Fig. 11.

of sufficient length below the collar, may now be heated, placed, screwed down in a hole in a heavy iron block, the collar resting on the face of the block, the plate in its place on the bolt, and a good round head formed.

Whatever may be said regarding the effect of domes, drums, and the like on the economy of the generation and distribution of steam, the fact remains that many such adjuncts are in use on stationary boilers, where there seems to be less excuse for complications that are not clearly beneficial than there is in locomotive or marine boilers. Notwithstanding the many arguments that are being, and have been for years, used against their economy, as well as their strength, yet they have many strong advocates, and as it is the business of the Hartford company to insure all insurable boilers that are offered, it is proper, and will do doubt be beneficial, if both parties to the contract study their weak features in order that a correct estimate may be made of

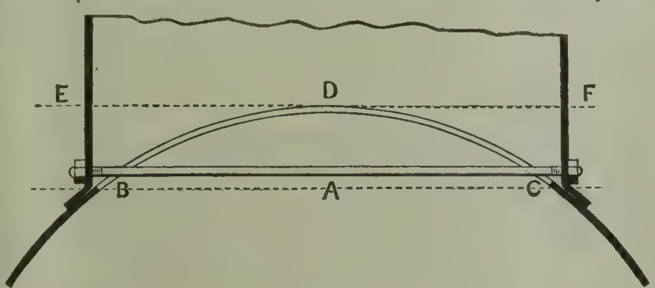


Fig. 12.

them, and as fair a judgment as may be formed as to whether they are really weaker than some other unavoidable weaknesses which are inherent in all forms of boilers. The longitudinal seam, for example, may be considered such a weakness, but the estimation of its strength, when made of fairly uniform material, is a simple problem compared with those to be applied to larger openings with everybody's guess-work reinforcements. The usual method of explaining the parts

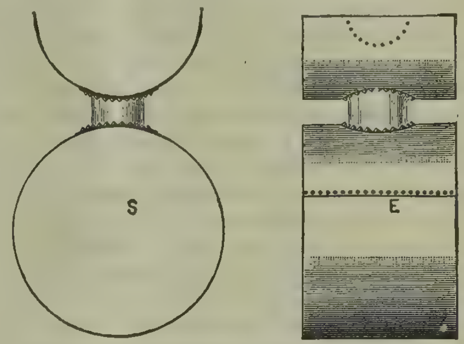


Fig. 13.

of steam boilers, as well as other structures, is by plain sectional drawings and elevations; but the section of a steam dome, as usually drawn on a plan, is well calculated to mislead those who are not familiar in a practical way with the subject. A good method for such readers is to examine the strength of a common hat brim in reference to its ability to resist a radial outward pressure at the plane where the lowest points of the cylinder join the brim, as at B C, Figs. 11 and 12. Pressing outward, with the hands placed at these points just inside the hat, it will be observed that the diameter G H, at a right angle to the line B C, is shortened, and the cylinder (supposing the body of the hat to be a true cylinder) is flattened about as much as the line B C is extended by the pressure inside. It is plain that fixing the points G and H so that they cannot approach each other will resist the extension of the line B C, more especially if the brim or flange is securely riveted all around to a firm object; then it seems that no extension can take place without stretching or splitting both the object at B and C and the brim at the points E F. In good boiler practice the arc B D C is a plate bent to the true circle due to the radius of the cylinder, and the flange of the dome is accurately formed to the same circle, and they are firmly joined with rivets pitched not more than two inches from center to center, and often by two circular rows. The plate represented in section by the arc B D C has a

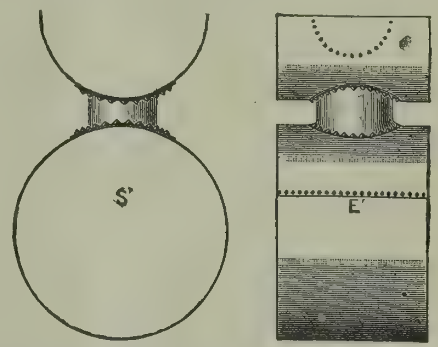


Fig. 14.

sufficient hole in the center for the passage of the steam, and small drip-holes at the low points B and C for the escape of the water of condensation back into the boiler. Now, in this condition the steam pressure will be alike on both the upper and the under side of this plate, and it appears on the drawing to be only a bent stay between the points B and C, and the tendency seems to be very strong when the points B and C, so held, are pressed outward, to depress the summit of the arc to A and reduce it to a straight line. But now, keeping in mind the form of the plate, which is that of an arched roof, and examining the plan A, Fig. 11, wherein the ridge or summit of the roof corresponds to the line G H, it will appear that in order to depress the arc the line G H must be curved down and extended, stretching or splitting the material, or drawing the points G and H towards each other. When, therefore, the points B

and C are really moved apart, the material of both cylinders, the dome and the boiler shell, must stretch or split somewhere. The material of which boilers are made does not admit of very much stretching; but any overpowering load on a dome will usually cause leaks at the low points and give due warning of distress, the significance of which must be estimated by the conditions in each case. This feature of the dome is the most complicated one in its construction; the head or cover may, however, be still weaker if not properly stayed. It is proposed to take this matter into consideration, along with the head-bracing of the main cylinder and that of other flat surfaces.

If, now, the part of the shell that is covered by the dome is all, or nearly all, cut away, as shown in Fig. 12, one considerable element of strength is destroyed; then if the dome is of considerable size compared to the main cylinder, say 30 inches diameter on a cylinder 48 inches diameter, as here drawn, then a stay-bolt should be put across from K to L, Fig. 12, which will effectually prevent motion and consequent leakage, as well as greatly strengthen the boiler shell on its weakest line.

It seems to be obvious that wherever it can be done, domes covering considerable areas of the shell should be avoided. If, however, the necessity of large storage room for steam is demonstrated or believed to exist, it may be readily and more safely provided by connecting some desirable form of storage vessel by suitable necks of such construction and size as to leave no room for doubt as to their being stronger than the longitudinal seams of the main cylinder.

The diagrams Figs. 13 and 14 are introduced for the purpose of comparing their weak features with those of the longitudinal seam in any given boiler sheet upon which it is desirable to attach a drum by means of a neck. Let Fig. 13 represent two views of a portion of a 54-inch shell having a 42-inch drum attached by means of a neck 12 inches in diameter, as shown. Of course it will appear that the part of the neck which extends below the summit of the cylinder is very trifling compared with the corresponding part in the large dome, F C, Fig. 12, and the brim or flange greatly strengthens the neck, and compensates in great measure for the weakening of the shell by cutting away the 12-inch disk for the opening. Neglecting this compensation, which of course varies with the thickness and consequent rigidity of the flange, let us compare the bare opening, as to strength, by the same rule that some teachers of boiler science use for similar calculations—namely, estimate the whole load on any longitudinal line of a boiler by multiplying the load on a unit of length of the line (say an inch) by the number of inches in the line to be considered. Without affirming or denying the correctness of this method, it may be said that if it is admissible for a whole boiler, it ought to apply in this case, which may be considered (barring the transverse seams, which are never considered in calculating the strength of the longitudinal seams) a fourth part of the length, the other three-fourths being uniform with it, the boiler having four necks. It is not uncommon to find boilers of this diameter running at very respectable pressure of steam, with longitudinal seam single-riveted, as shown in Fig. 13. And this practice, which is not approved of or recommended by the Hartford company, is not only tolerated, but actually defended by the present practice of boiler-makers of long experience and of more than average intelligence and enterprise as business men. The acknowledged weakening effect of the longitudinal lap-joint E, Fig. 13, due to a row of rivet holes of the ordinary diameter and pitch, is from 35 to 45 per centum of the original strength of the plate, leaving from 55 to 65 per centum remaining; and it is easy to compare by the above rule the strength of a longitudinal line passing through the uncovered neck-hole, which is its very weakest state, having possibly two rivet holes in the same line, the main opening being 12 inches diameter, and the two small ones each ¾ of an inch, making 13½ inches, and the whole plate in which they are cut being 48 inches, we have 13½-48ths of the line at the summit of the arc cut away; this is about 28 per centum of weakening, against an average of 40 per centum in the longitudinal seam, as above. But when the neck is properly secured to cover the openings, the strength is restored to a degree that varies with the correctness of the proportions and the workmanship. This class of work is very apt to be bungingly performed by the workman by attaching a rigid flange, say of cast iron, of the wrong curve, or of no particular curve at all, to the cylinder, and so distorting its form, which the internal pressure will restore, or place the parts in a much higher state of tension than what would be due to legitimate strains, which are always the ones contemplated by the rules for estimating them. The neck thus properly proportioned and well made, is far stronger than the longitudinal seam. As necks of larger size become necessary, their strength should be increased and the work should be done with greater care, never leaving a doubt about their being much stronger than any seam in the structure.

[The foregoing we select from the *Locomotive*, issued by the Hartford Steam Boiler Inspection and Insurance Company.]

Scientific.

"Association" Notes.—The thirtieth annual meeting of the American Association for the Advancement of Science, which was opened August 18th, in Music Hall, Cincinnati, O., under the presidency of Prof. George J. Brush, of Yale College, was characterized rather by the number and general excellence of the papers read than by the presentation of any striking or remarkable discovery.

After the usual formalities of opening the session had been gone through with, the scientific work of the association was begun. In section A, the first paper read was by Chairman Mallery, on the "Gesture Speech of Man." Referring to the survival of gesture signs, which he believed once universally prevailed, the speaker held that where sign language survives, it may be regarded as an instructive vestige of the prehistoric epoch, and its study may do much to solve many perplexing problems in philology and psychology. At the evening session, Capt. Clarence E. Dutton read an interesting paper on the "Grand Cañon of the Colorado River." The paper was illustrated by pictorial views of various portions of the great chasm. The speaker gave an outline of the geology of the region embracing the cañon, and briefly explained the process by which it had been excavated. This he ascribed to the action of two natural causes. The first is the scouring action of the stream upon the rocks in its bed. The stream is a fierce torrent, carrying large quantities of sharp sand, which acts like the sand-blast; and as the Colorado always carries less sediment than it is capable of carrying, its bed is constantly being cut deeper by erosion. The other process is weathering. The stream cuts a chasm no broader than its water surface, but the cut thus made is widened by the secular decay of the walls of the chasm, which, though very slow, becomes great after the lapse of time. Capt. Dutton described the cañon as being 220 miles long, from 5 to 12 miles wide, and from 5,000 to 6,000 feet deep. Those who have seen it, all unite in declaring it to be the most sublime and impressive sight in the world.

At the second session of section A, the first paper was by Prof. J. E. Hilgard, of the Coast Survey, entitled "On Recent Deep-Sea Soundings in the Gulf of Mexico and the Caribbean Sea by the U. S. Coast Survey." This paper, among other interesting facts, demonstrated that the Gulf of Mexico is not a shallow continental sea, like the Irish Sea for example, but a true oceanic body, having depths as great as the Atlantic. Following this was a paper by Prof. R. H. Thurston, on "The Effect of Prolonged Strains on Timber." Mr. H. C. Hovey spoke upon "A Remarkable Case of the Retention of Heat by the Earth," referring to the case of an ancient bed of ashes buried thirty feet deep, in Nova Scotia, on the top of a bed of bituminous coal, and having great trees, several centuries old, growing on top of it. This bed of ashes still retains appreciable traces of the heat of its ancient fires.

Of the other papers read before section A, the following were the most interesting: "On the Electrical Resistance and Coëfficient of Expansion of Incandescent Platinum," by E. L. Nichols; "On a Simple Mode of Measuring Faint Spectra," by Wm. Harkness; "Suggestions for Improvement in the Manufacture of Glass, and New Methods for the Construction of Large Telescopic Lenses," by G. W. Holley; and on "The Stereoscope and Vision by Optic Divergence," by W. Le Comte Stevens.

In section B, besides a number of papers on natural history and palæontology, the following papers of general interest to the readers of this journal were read: "Typical Thin Sections of the Rocks of the Copper-Bearing Series in Minnesota, by N. H. Winchell; and on "The Cause of the Arid Climate of the Far West," by Capt. C. E. Dutton. In section D, sub-section of anthropology, a number of papers were read relating generally to the ancient inhabitants of the North American continent.

In the absence of Prof. A. G. Bell, two papers by him were read; one was entitled "On the Use of the Induction Balance as a Means of Detecting the Location of Leaden Bullets in the Human Body," and gave an account of the experiments made to locate the bullet in the body of our late President. The other was upon "A New Form of Electric Probe," describing the experiments which have led to the discovery that the presence of a bullet embedded in the human body in any suspected locality, can be demonstrated by the insertion through the skin of a fine needle electrically connected with the telephone. Prof. H. T. Eddy described a "New Method of Applying Water-Power of Small Head to Effect the Direct Compression of Air to any Required High Pressure." Dr. J. Lawrence Smith described "The Needle Telephone," a new instrument invented by Dr. Goodman, of Louisville, Ky. Dr. Smith described the arrangement of the new instrument, which makes use of needles arranged between two coils and a tightly stretched diaphragm, in place of the coils and loose diaphragm of the ordinary instruments. He affirmed that the needle telephone is superior to the instrument now in use, but that it could not be used at present, on account of existing patents. He hoped that a transmitter, on some principle not covered by existing patents, would be invented, which would enable Dr. Goodman's invention to be used. A number of astronomical papers were also read in the physical section.

In the department of physics, the most interesting papers were the following: "On the Wave Lengths of the Principal Lines of the Solar Spectrum," by Prof. T. C. Mendenhall. Mr. Wm. H. Ballou read a paper on a subject of very general and commercial importance, namely, "The White Pine; its Origin and Natural History; Statistics of its Industry in Michigan; the Coming Substitute for Lumber." Mr. Ballou showed that at the present rate of consumption, the supply of white pine would be exhausted in about seven years. Referring to this impending scarcity, the author remarked: "Science will doubtless devise other material as a substitute—indeed, I have been shown a material manufactured in Chicago, in the shape of a board one inch thick, made from wheat straw, which can be colored to represent any lumber now known, so accurately as to deceive the eye. The inventor manufactures two thousand square feet from one ton of straw. It is more durable and much cheaper than lumber. As a parallel to the use of paper car-wheels, Mr. Pullman is now finishing off three palace cars in this material. The limit of its manufacture will depend only on the production of wheat straw."

In the section of chemistry, the first paper was by Mr. H. C. Hovey, on "Coal-Dust as an Element of Danger in Mining." The facts on which the paper was based were derived from the Albion Mines explosion,

and the author claimed the following points to be proved, viz.: "1. That coal-dust, under favorable conditions, becomes the vehicle of flame. 2. That it thus spreads and augments gas explosions. 3. That it may determine and precipitate explosions due to the presence of inflammable gas in otherwise harmless and scarcely appreciable quantities." Professor Peckham, whose interesting discussion of the Minneapolis flouring mills explosion appears elsewhere in this journal, spoke upon the conclusions of this paper, claiming that coal-dust, when finely pulverized, must be regarded as an active explosive agent, and not merely as a vehicle of flame. He referred in his remarks about the Minneapolis explosion in support of this view, and affirmed that the subject was one of the first importance to mill and mine owners. The other papers in this department were generally of purely theoretical interest.

The geological section, as usual, afforded a number of papers, among which, however, we notice none having a directly practical bearing, save one by Dr. George Sutton, of Aurora, Ind., on "The Gold-Bearing Drift of Indiana." He traced the existence of a gold-bearing drift across this State in a northwest and southeast direction, along which line the drift is comparatively rich in gold. Referring to the glacial origin of this deposit, he stated that there was a vast extent of our country to the north of the great lakes, from which the glaciers moved, that was as yet unexplored; and he held it to be probable "that rich gold veins might be discovered beyond the lakes, that would give rise to all the excitement incident to the discovery of new gold fields, and the miner, the capitalist, the speculator, the emigrant and the adventurer may hurry to a region which is now a barren wilderness; villages, cities and railroads spring into existence as if by magic, and scenes be enacted in the North similar to those that we have so recently witnessed in the West."

A movement was started at the Cincinnati meeting looking to the formation of an American geological society. The association decided to hold its next annual meeting at Montreal.

Monster Telescopes.—It seems to be a law of optics, in the use of the kind of telescopes known as refractors, that no amount of increased size in the object glass, beyond a diameter of perhaps 28 to 30 inches, will avail to improve the powers of the instrument. What is gained in magnifying or space-penetrating power, is lost in the diminished clearness of definition.

But the astronomers and telescope makers do not all believe in this law. The great glass ordered in this country by the Russian government, and which is now in the slow and patient process of transformation from a rough and bulky disk of glass into the ground-down, scientifically-shaped and polished lens of a great telescope, is one proof of the conviction that increased size in a refractor should give increased power. The great glass at Washington, by which the moons of Mars were discovered, is in diameter 26 inches; the one ordered for the Russian observatory at Pulkowa is to be at least 30 inches. Even that, it appears, is not to be the largest of the refractors. The trustees of the Lick Observatory in California have finally closed the contract for the optical part of the great telescope provided for by the will of the California millionaire. There has been considerable doubt whether a refractor or an enormous reflector would be selected, but the decision is in favor of the former. The object glass is to be three feet in diameter, and the Clarks, of Cambridge, Mass., (who are making the glass for Russia), are to make this California lens for $50,000. The mounting for the instrument is not yet provided for. Proposals will be obtained from the principal instrument-makers of Europe and this country before the contract is awarded. Probably the mechanical part of the instrument will cost about as much as the optical. It cannot probably be completed in a less time than three years.

It is believed by many that the power of this monster glass (for, compared with other refractors, it is a monster, though reflectors are constructed of a much larger size) will be proportionate to its size. If it does prove successful, it will be by far the most efficient glass ever pointed at the heavens, and under the clear skies of California ought to accomplish great things for science.

Electric Lighting at Railway Stations.—The *Bulletin du Ministere des Traveaux Publics* contains some interesting data on the lighting by electricity of large railway stations in Germany and France. The Eastern railway station at Berlin—a large hall 616 feet long and 114 feet wide—has been lighted since September, 1879, by 14 lamps, placed 23 feet above the platforms, and supplied by a 10-horse engine. The installation was by Messrs. Siemens, of Berlin, who supply the light at a charge of 9fr. 22c. per hour, or .658fr. per hour per lamp. The Anhalt station at Berlin, 820 feet long, 205 feet wide and 95 feet high, is lighted by 20 lamps suspended at a hight of 21 feet 3 inches above the platforms. The cost of first establishment, not including motive power, was $6,750. At Dusseldorf, the large vestibule of the station and one platform 492 feet long, is lighted by electricity, the cost per hour and per lamp being .311fr. The new station at Munich, not yet completed, will be lighted by 45 lamps, divided into nine circuits and worked by 4 gas engines. In France electric lighting has been employed at the Northern station since 1875, and at the Lyons station since 1877. The night work done at the Chapelle station is very important, and in winter often amounts to 15 or 16 hours per day. It was to obtain a better light and increase the work done, which fell at night to one-half of that done in the day, that the Northern Company decided in 1875 to try the electric light. The installation consisted of 5 Gramme magneto-electric machines, requiring 2.5 horse-power, and costing $300 each. As arranged at a hight of 18 or 20 feet, each lamp lights an area of 200 feet radius sufficiently for all the requirements of work. Each of the lamps, when working for ten hours, cost .556fr. per hour. If interest and a sinking fund be added, the cost rises to .80fr.—that is to say, to the standard price of gas. The Paris, Lyons & Mediterranean Company, after having a series of satisfactory trials, which lasted for forty-five days, in 1877 adopted the Lontin system to light their goods sheds. The installation, costing $9,400, comprises 18 lamps, the cost of which, including all charges over a service of 4,000 hours a year, is .295fr. per hour per lamp, or, including interest at 10 per cent, .346fr., which is about the cost of 10 gas jets. The waiting-room of the Saint Lazare station is also lighted at a cost of .65fr. per hour.

Chemical Test Papers.—Among the most useful, though at the same time the most simple, auxiliaries in the hands of the analytical chemist, are "test papers." These are small strips of bibulous paper which have been saturated with certain vegetable tinctures, and indicate, by an immediate change of color, the presence of an acid or an alkali in a given solution. They are made up in the form of little books, and a strip can be readily torn off when required. Blue litmus paper has been steeped in a tincture made from a kind of lichen (*Rocella tinctoria*) growing abundantly in the Canary and Cape Verd Islands. This paper turns red when dipped into a liquid having an acid reaction. Red litmus paper, which had been reddened by an acid, is used as a teet for alkalies, which restores the blue color. An amusing experiment may be performed by placing a drop of some acid at the bottom of a tall vessel, and pouring in a solution of blue litmus. The blue color is immediately changed to red. The experiment may be reversed by pouring the reddened liquid into another vessel containing a drop of ammonia. The blue color will reappear. These changes appear extraordinary to the uninitiated. Yellow turmeric paper has been steeped in a tincture made from the roots of the *Curcuma longa*, a plant growing in all parts of Bengal. Its color is changed by alkalies to brown. It must not be forgotten that this property is possessed by some substances that are not, strictly speaking, alkalies. For instance, carbonate of soda is a salt, but it changes red litmus to blue; we can, therefore, only say with correctness that it has an alkaline reaction. There are other test papers, such as ozone papers, for detecting ozone in the atmosphere. These are impregnated with starch paste and iodide of potassium, and turn blue when acted upon by minute quantities of ozone. Then we have lead-papers, which turn black on exposure to sulphuretted hydrogen.

Spontaneous Combustion.—The most frequent instances of this happen with cotton rags or waste, that may have been more or less saturated with oil. Few people are aware of the ease with which these materials originate fire. Two or three bushels of rags wet with linseed oil, the drying oil such as painters use, left in a heap, have been known to char in the interior within little over an hour, and then, after smoking awhile, and being placed where there was a slight current of air, burst suddenly into a blaze. Painters rags are probably quicker at this performance than the waste used in oiling machinery and in printing offices; but there is plenty of evidence to prove that even the heavier oils thus thinly spread in cotton stuff, will heat, if in a mass, and start a fire. One of the largest printing and lithographing establishments in Boston is obliged, by the terms of its insurance policies, to take out of and away from the building, every night, all the oiled rags used about the machinery during the day time. A little care on the part of manufacturers will go a long way towards reducing the number of cases of fire from spontaneous combustion; and they should remember that, given certain conditions, such as the piling of oiled rags, etc., fire is not an accident, but an inevitable conclusion.

Electricity in Agriculture.—The application of electricity to locomotion has advanced a step, and it is now used in agriculture. The last experiment is reported from the electrical exhibition now in progress in Paris, and consists in the use of the Gramme machines for ploughing. The work of eighteen horses is done by a pair of these machines attached to a reversible plough constructed for the purpose. The use of electricity as a motive power is yet in its infancy, at the best; but when it is demonstrated that it can be employed for one kind of motion, its application to a thousand other kinds is only a question of ingenuity and time. The possibility of running tramway cars by electric energy is believed to be entirely settled, although the mechanical difficulties have not yet been entirely mastered.

Silver in Commercial Bismuth.—Years ago, R. Schneider called attention to the frequent presence of silver in commercial bismuth. Several investigators have lately confirmed this fact, and have shown that in some cases considerable percentages of the precious metal are present. One Bolivian sample showed the presence of no less than 0.62 per cent of silver, corresponding to 224 ounces to the ton. A Saxon sample showed the presence of 64 ounces to the ton; and other samples respectively of 22.4 and 30 ounces. It has been suggested in view of this interesting fact, that many of the ores from which bismuth is now produced, could be profitably worked for silver.

Reaction for Potassium.—Dr. Koninck, in the *Zeitsch. f. Anal. Chem.*, announces that a reaction for potassium, much more sensitive than platinic chloride, is obtained by adding to a solution of nitrate of sodium containing about ten per cent of this salt, a little cobaltous and acetic acid. This reagent produces, in a solution containing one per cent of chloride of potassium, immediately a red precipitate. The latter is still obtained when the solution is diluted to 1 in 1,000; but at a dilution of 1 in 2,000, no precipitate makes its appearance. Ammonia salts produce a similar but less sensitive reaction. Salts of magnesium, calcium, barium, strontium, iron, aluminum and zinc are not precipitated by this reagent. The reaction is, in the main, nothing else than an inversion of the well-known reaction for cobalt by nitrite of potassium.

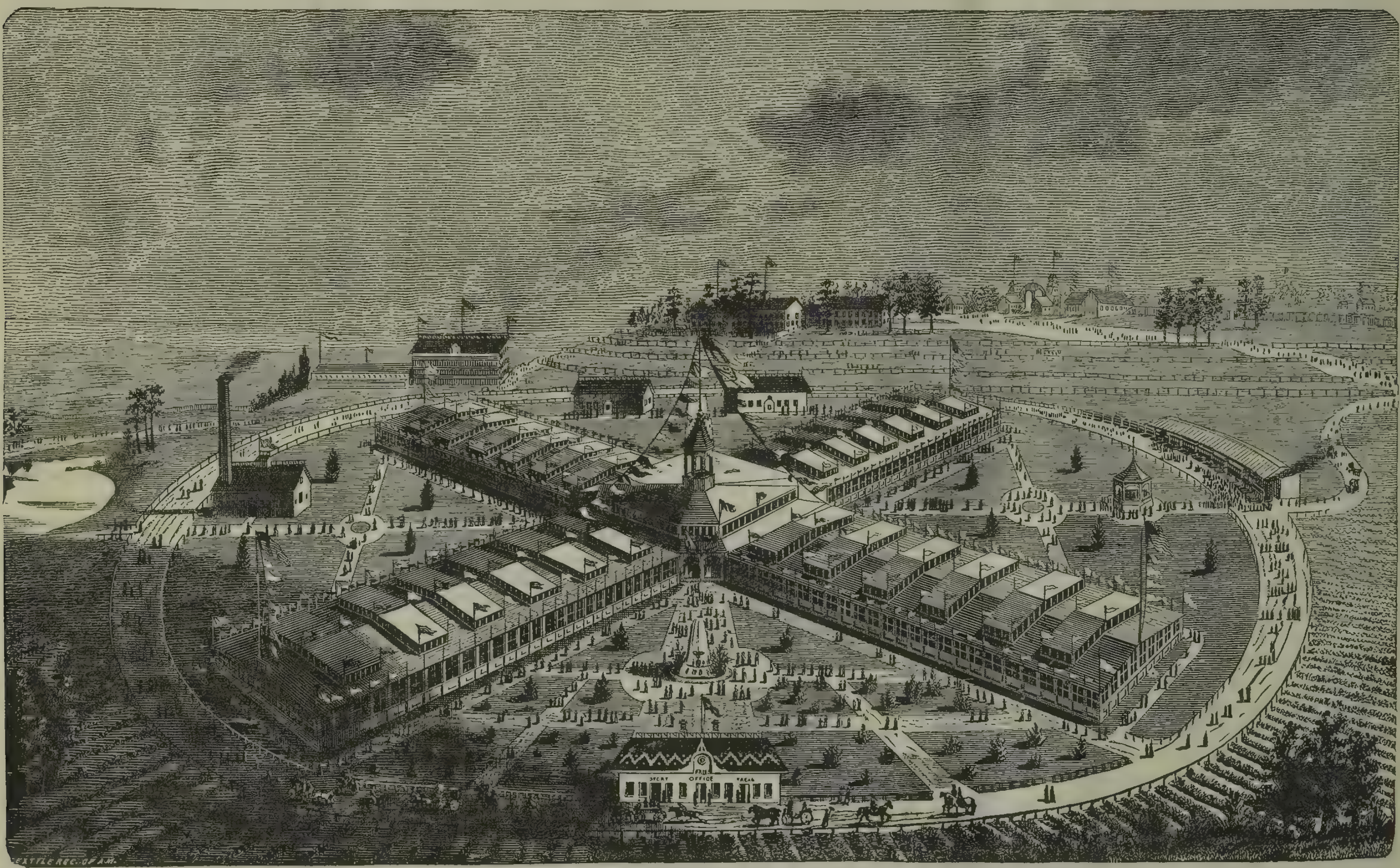
The Atlanta Exhibition.

Through the courtesy of the Director-General, we are enabled to place before our readers an excellent view of the buildings of the Atlanta Exhibition, which promises to be an important event in the industrial development of the Southern States. The exhibition was originally intended for the display of cotton and its manufactures, and was known for a time as the "Atlanta Cotton Fair," a name which fully indicated the intentions of the originators of the project. But so universal became the interest in the project that it grew far beyond the designs of its originators, and from a cotton exhibition it has developed into a grand display of the agricultural, mineral and manufacturing resources of the Southern States, in which the Northern section of the country, and even Europe, are largely represented. The display of textile products, fabrics, and machinery for manipulating and manufacturing the same, nevertheless remain the principal feature of the exhibition.

The exhibition is being held in Oglethorpe Park. The buildings provided for the purpose are ample. They consist of a central building, devoted to the display of textile products and fabrics and the machinery for manufacturing the same. Radiating from this central structure are numerous other buildings or wings, appropriated for the display of other staple products of the South, such as sugar, rice, tobacco, and machinery for preparing the same; while others contain a comprehensive collection of the general agricultural and mineral products and resources of the Southern States. The railroad companies of the South and Southwest have interested themselves in the scheme of making this exhibition a truly representative one of the natural wealth of that section of our country; and from all appearances, it promises to prove eminently successful. Of late years, the necessity of developing its manufactures has impressed itself upon the minds of the enterprising element of the South, and this subject has been the standing topic of discussion with the newspapers of that section. To this idea, doubtless, our Southern neighbors are indebted for the great popularity of the exhibition project and its development to proportions far beyond the limited views of its originators. No similar opportunity has ever been afforded the people of the South to give to the world a proper conception of the great sources of natural wealth of their section, and of the possibilities which await the establishment and development of manufacturing industries there.

The exhibition will be the great opportunity of the Southern States, and from the activity and energy that have been displayed in its preparation and arrangement, it has become evident that the opportunity will be utilized to its fullest extent. It promises to mark the beginning of a new era in the industrial history of that section of our country.

The exhibition was opened on the 5th of October, and will be continued until the end of the year. During the progess of the exhibition, excursion tickets will be sold between New York and Atlanta at $36, good to return within 30 days from date of purchase.



INTERNATIONAL COTTON EXPOSITION BUILDINGS, ATLANTA, GA.

Measuring the Power of Belts.

The *Mechanical Engineer* mentions a simple, and, it thinks, effective device for measuring the power of driving belts, without going into any tedious dynamometric calculations. An ordinary two-part clamp, with a hook on one plate, is secured to the belt, and to the hook is attached a common spring balance such as icemen use. The other end of this is in turn fastened to the nearest wall or timber that will give a direct pull. The engine is then started, and the reading of the spring balance at the moment the belt slips is the actual resistance or tension of the belt on the pulley. This, multiplied by the speed of the belt per minute, gives the total foot-pounds transmitted by it for the time reckoned. This will, it is thought, prove a very useful device for parties hiring power, as there cannot be any question of accuracy of calculation, any theories of width of belt per horse-power, or any error of any kind, because the actual dead pull of the particular belt in question under test, with all its perfections or imperfections as they actually exist, is given.

Quicksilver.

One of the most curious properties of quicksilver is its capability of dissolving or forming amalgams with other metals. A sheet of gold foil dropped into quicksilver disappears almost as quickly as a snow-flake when it drops into water. It has the power of separating or of readily dissolving those refractory metals which are not acted upon by our most powerful acids. The gold and silver miners pour it into their machines holding the powdered gold-bearing quartz, and although no human eye can detect a trace of the precious substance, so fine are the particles, yet the liquid metal will hunt them out and incorporate them into its mass. By subsequent distillation, it yields them into the hands of the miners in a state of virgin purity.

Several years ago, while lecturing before a class of ladies on chemistry, we had occasion to purify some quicksilver by forcing it through chamois leather. The scrap remained on the table, and an old lady, thinking it would be very nice to wrap her gold spectacles in, accordingly appropriated it to this purpose. The next morning she came to us in great alarm, stating that the gold had mysteriously disappeared, and nothing was left in the parcel but the glasses. True enough, the metal remaining in the pores of the leather bag amalgamated with the gold, and entirely destroyed the frames.

AN EXPLOSIVE ALLOY.—An alloy of rhodium and lead, lately exhibited before the French Academy of Sciences, has the curious property of exploding on exposure to heat, as in being held before a gas flame. Its composition is one-third rhodium and two-thirds lead, fused together in a crucible at a high temperature.

The Boston Fairs.

Boston to-day is setting the other cities of the Union a lesson in the way of enterprise that her manufacturers and business men may well be proud of, for there are no less than two fine exhibitions of American manufacturers in full blast, in two of the finest buildings in the country, specially erected for the purpose. One of these exhibitions is that of the Massachusetts Charitable Mechanic Association, an old and honorable association, widely known throughout the country as among the most useful of the numerous institutions for the promotion of the useful arts; and the other is by a new organization—the New England Manufacturers' and Mechanics' Institute, the nature and organization of which we have noticed in previous issues of this journal. The inaugural exhibition of this institute has won universal praise not only for the extent and variety of the exhibits presented, but for their representative character and importance.

In addition to the list of exhibitors named in our September number, we add the following notices of representative firms whose productions are shown: The largest and most prominent single exhibit at this fair, and that which naturally attracts a large share of the attention of visitors, is that of Messrs. Houghton, Coolidge & Co., who exhibit a "Model Shoe Factory" in full operation. This exhibit is a regular manufactory of boots and shoes by machinery, and shows every detail of the industry as it is at present carried on in hundreds of New England manufacturing towns, with all the most approved machinery. About 100 hands are at work, and the operations are of the most interesting character. A striking contrast between the "old and new" is afforded by the sight of a venerable shoemaker hard by working away on his bench in the old fashion. Messrs. Locke & Wood, of 38 Hawley street, Boston, exhibit a novelty in the shape of an angular wood turning machine, which excites much attention from those who are of a mechanical turn of mind. This machine cuts knobs, handles, etc., from cylindrical blocks of wood, up to 3½ inches in diameter, with any number of angles up to twelve, or of oval form if desired. The machine is perfectly automatic, and is capable of producing a surprising amount and variety of ornamental work. Boynton & Plummer, of Worcester, Mass., have a very meritorious display of hand and power machinists' and blacksmiths' tools, including various styles and sizes of drilling machines, bolt-cutters, and shaping machines. The Stiles & Parker Press Co., of Middletown, Conn., exhibit a drop hammer with 200 pounds drop.

Cording and weaving machinery, as representing New England's preëminence in the manfacture of textiles, are fully represented by numerous exhibitors.

Among the miscellaneous exhibits, we should notice that of Chas. W. Trainer & Co., of Boston, who make a creditable display of asbestos products, including asbestos paints of various kinds, asbestos boiler and pipe coverings, asbestos packing, asbestos boards, paper and cloth. These products are all from the well-known establishment of the H. W. Johns Manufacturing Co., of this city.

The Pope Manufacturing Co. and Cunningham & Co. make attractive exhibits of bicycles and tricycles, all of which are elegant specimens of construction. T. B. Adams & Co. make a fine exhibit of leather belting, and of various articles connected with its use, including the Whitney strong-hold belt clasp and the Chapman patent fasteners. The Weston Electric Light Co. illuminate the front and interior of the exhibition in a very satisfactory manner by their system of lighting.

B. F. Sturtevant, of Boston, besides his other exhibits of blowers and exhaust fans, has a No. 10 blower and engine combined, the engine driving the main shaft of the blower direct.

The Brainerd Milling Machine Co., of Boston, exhibit a 30-inch gear-cutter in operation; three milling machines with micrometer head, capable of cutting gears as well as milling; Nos. 4 and 5 milling machines; also grinding machines.

George H. Corliss, of Providence, R. I., exhibits a full sized working model, showing the valve which was to have been used in the engine ordered by the Committee on Improved Sewerage of the city of Boston, with diagrams showing its exact action in the pump cylinders.

John A. White, of Concord, N. H., exhibits band saws, pony planer, molding machine, cutter and grinder—all wood-working machinery.

The School of Mechanic Arts of the Massachusetts Institute of Technology exhibit productions from their course of study. This includes pattern-making, the casting made from the pattern, and the casting finished by machine tools or hand. This school also exhibits a steam engine, hanger pattern, balance wheel at the top, and cylinder on the base, every portion of which was designed by four students of the school of the class of '80, and all the mechanical work was done by one of the number, with the exception of the globe valve, oil cup and governor. It is a working model or small engine. The mechanical engineering school of the institute exhibit a series of finished work, consisting of tools, patterns, models, etc. The department of architecture exhibit a variety of thesis drawings of various subjects from the architectural course.

In the exhibition of the Charitable Mechanic Association, which rivals that of the Manufacturers' and Mechanics' Institute in magnitude and variety of display of textile products and machinery, and of shoe and leather machinery, is especially noticeable and creditable. The motive power for the machinery is supplied by one of the well-known engines of Jerome Wheelock. This admirable machine is of 115 horse-power, and performs its allotted task with complete satisfaction. The horizontal tubular boilers which furnish the steam, are models of correct proportions and workmanship. They were built by the Whittier Machine Co., of Boston. This company also supply the building with two admirable steam passenger elevators. These machines are supplied with the Baldwin patent safety attachment, to provide for the accident of a break in the hoisting rope, and run at a speed of 160 feet per minute.

One of the greatest curiosities is an automatic paper collar machine at work. From a roll of prepared paper it makes 148 collars a minute. At every stroke of the die it throws out two collars, complete for wearing, with the exception of a slight folding. The Reversible Collar Co., of Boston, are the exhibitors.

J. A. Salmon, of Boston, shows a novelty. It consists of a collection of portable steam heaters, five styles in all, designed for offices, railroad cars, street cars, etc. They are neat, and very easily moved about a room. He also shows a new portable range boiler and heater operated by gas.

One curiosity is a cast steel ingot, weighing 20,000 pounds, apparently without a flaw, cast by the Norway Iron and Steel Works, of Boston.

C. E. Mayo and W. L. Perry, of Lowell, exhibit a new foot-power treadle applied to various machinery. It operates by friction, is noiseless, and easily driven.

An assortment of machine-cut small gears, and a peculiar calculating machine, comprise the exhibit of George B. Grant, of Boston.

Nathan & Dreyfus, of New York, exhibit the Friedman injector.

Jenkins Bros., of Boston, exhibit their patent packing; also steam and water valves of various sizes.

T. Shaw, of Philadelphia, exhibits his quieting nozzle and locomotive exhaust.

In the boiler room the Peerless fire and steam regulator is applied; also an Edson recording steam gauge.

The Boston Blower Co. show a variety of sizes and styles of blowers, exhaust fans, shaving exhausters, cupola and forge blowers.

A new combination bench lathe and screw machine is shown by A. C. Winn, of Boston. It has hollow spindle, conical bearings and split chucks, and will also receive a scroll chuck, if desired. For making screws the lathe has a turret attachment.

Among other mechanical exhibits, that of Wm. A. Harris, of Providence, R. I., is especially worthy of mention. This exhibitor displays one of the well-known Harris-Corliss engines, which is generally admired as a fine example of the perfection to which the art of engine-building has been brought in this country. This engine is of 65 horse-power, and operates the electric light machinery. Of the hydraulic machinery, the display of which was incomplete at the time of preparing this notice, the Worthington duplex pump was among the most noticeable of the exhibits.

The Knowles Steam Pump Works, of this city and Boston, have a very fine display of pumps.

Very creditable steam pump exhibits are made by the Deane Steam Pump Co., of Holyoke, Mass., and the Valley Machine Co., of Easthampton, Mass.

J. A. Locke & Son., of this city, exhibit Reed's covering for steam pipes, boilers and water pipes.

Rufus Brown & Co., of Boston, make a fine exhibit of steam-heating apparatus that attracts much attention. Of miscellaneous exhibits, that of the Boston Knob Co. in the Grand Hall is a notable novelty. This company shows a new application of that remarkable substance, celluloid—namely, to the production of door knobs. The company show several hundred varieties of celluloid door knobs, most of them highly ornamental and beautiful, which cannot fail to meet the warm approval of architects and builders. They are made of metal, covered with celluloid, and in addition to being very attractive in appearance, are claimed to be remarkably strong and durable. The very extensive and beautiful display of military arms made by the Colt's Fire Arms Co., of Hartford, Conn., should not be passed by unnoticed.

In addition to the distribution of gold, silver and bronze medals which will be made to meritorious exhibits by the Board of Judges, the Grand Gold Medal of the association will be awarded to the exhibit in the fair, which, in their opinion, shall most promote human welfare. This Grand Medal of Honor is described as being of very elegant design, and will be an award of which the successful recipient may be proud of.

Semi-Centennial Exhibition of the American Institute.

The fiftieth annual industrial exhibition of the American Institute was formally opened on Wednesday, September 14th, in the presence of a large and interested body of spectators. The opening address was made by the President of the institute, Mr. Nathan C. Ely, who spoke in a most interesting manner of the progress of the industrial arts during the past fifty years, and especially of the important part played in this advancement by the American Institute, through the encouragement and opportunities afforded by its annual exhibitions. He was followed in similar strain by Mr. Orlando B. Potter.

The exhibition this year compares favorably with those held in former years, and noticed in this journal, and while we cannot look upon the display as being remarkable in any single feature, it very fairly maintains the reputation of the institute. The motive power is furnished by the well-known Whitehill improved automatic cut-off engine, made by Robert Whitehill, of Newburgh, N. Y.

Among the exhibits that attracted our special attention, was a fine line of machinists' tools exhibited by E. E. Garvin & Co., of this city. George Hayes, of this city, exhibits many of his valuable improvements in skylights and ventilating apparatus. Arthur E. Rendle, of this city, has a fine display of glass roofing showing his admirable system, which has been fully described in these columns. The H. W. Johns Manufacturing Co., of this city, show their asbestos products. The Hazard Manufacturing Co., of this city, display the Champion barbed wire. A. Aller, of this city, has a number of steam appliances on exhibition, including the Curtis regulator and Korting's Universal injector.

Our limited space precludes the review of other exhibits in the present issue, and we will reserve the balance of our notes for November.

Latest Market Report of Building Materials.

NEW YORK PRICES.

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	21 00 a 22 50
Pine, common box	18 00 a 20 00
Pine, common box, ⅝	16 00 a 18 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	30 a 32
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	23 a 25
Pine, strip boards, merchantable	17 a 19
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	25 a 27
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch,	43 a — 44
Spruce wall strips	14 a — 16
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	48 00 a 52 00
Cypress, 1, 1¼, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	110 00 a 120 00
Black walnut, ⅝-inch	80 00 a 90 00
Black walnut, selected and seasoned	150 00 a 175 00
Black walnut counters, per ft	20 a 25
Cherry, wide, per M	90 00 a 110 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	35 00 a 40 00
White wood, ⅝ panels	45 00 a 50 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 00 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	22 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	4 00	a 4 50
Up Rivers	5 75	a 6 50
Jersey	5 50	a 6 12½
Haverstraw Bay	6 75	a 7 00
" " choice	7 25	a 7 50
Favorite Brands	8 00	a 9 00
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown, per M.	11 00 a 12 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	30 00 a — —
Trenton	28 00 a 30 00
Baltimore	40 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	25 00 a 25 50
" Glengarnock	23 50 a 24 00
" Eglinton	22 50 a 23 00
" American, No. 1	25 00 a 26 00
" American, No. 2	23 00 a 23 50
" American, forge	21 00 a 22 00

LEAD—PER 100 POUNDS.

German	— — a — —
English, common	— — a — —
Spanish	5 75 a — —
Foreign, refined	— — a — —
Bar	6 50 a — —
Sheet	7 50 a — —
Pipe	— — a — —
Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 00 a 3 10
8d and 9d, common	3 25 a 3 35
6d and 7d, common	3 50 a 3 60
4d and 5d, common	3 75 a 3 85
3d and 4d, light	4 50 a 4 60
3d, fine	5 25 a 5 35
2d, fine	5 25 a 5 35
Cut spikes, all sizes	3 25 a 3 35
Clinch nails, 1¼ to 1¾ inch	5 25 a 5 65
do. 2 to 2¼ inch	5 00 a 5 35
do. 2½ to 2¾ inch	4 75 a 4 85
do. 3 inch and longer	4 50 a 4 60

TIN PLATES.—Duty, 1 1-10 cents per pound.

I. C. charcoal, 10x14, per box	6 25 a 6 50
I. C. coke, 10x14	5 25 a 6 00
I. X. charcoal, 10x14	8 00 a 8 25
I. C. charcoal, 14x20	6 25 a 6 50
I. X. charcoal, 14x20	8 00 a 8 25
I. C. coke, 14x20	5 25 a 6 00
I. C. coke, terne, 14x20	5 00 a 5 25
I. C. charcoal, terne, 14x20	5 25 a 5 50

SOLDERS.

Half and half	— 14½ a — —
Exra	— 13½ a — 13¾
No. 1	— 12½ a — 12¾

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7⅛ a — 7¼
Sheet, (open)	— 7½ a — 8

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a — —
do do No. 1, blue, in rough	— 85 a — 95
Bedford Stone	1 25 a — —
Berlin Freestone, in rough	— 75 a 1 00
Berea Freestone, in rough	— 75 a — 00
Brown Stone, Portland, Conn	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a — —
do Mary Point Brown Stone	1 00 a — —
do do Olive Stone	1 00 a — —
Brown Stone, Belleville, N. J.	1 00 a 1 35
Granite, rough	— 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a — —

PAINTS.

Carmine, American, per lb	5 00 a 5 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6¾ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil	— 9 a — 10
Litharge	— 6¾ a — 7
Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
Orange Mineral, English	— 9 a — 10
Paris White, American	— 1¼ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
Vermilion, Chinese, per lb	— 85 a — 90
Vermilion, Trieste	— 70 a — 75
Vermilion, quicksilver, bags	— 50 a — 52½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
Zinc, white French, dry, (Red Seal,)	— 7 a — 8
Zinc, white French, in oil	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 50 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 15 a 1 25

DEADENING AND ROOFING MATERIAL.

Mineral Wool for Roofs and Deadening, per lb.	— 1¼ a — 1½

HAIR.

Cattle, per bushel of 7 lbs.	— 16 a — —
Goat, " "	— 21 a — —

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	1 00 a — —
" finishing	1 25 a — —
Rockland, common, cargo rate	1 10 a — —
" finishing	1 25 a — —
Ground	1 00 a 1 10

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 28
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

LABOR.

Ordinary, per day	2 00 a 2 50
Masons, do	4 00 a 4 50
Plasterers, do	4 00 a 4 55
Carpenters, do	4 00 a 4 20
Plumbers, do	4 00 a 4 50
Painters, do	3 00 a 3 50
Stone-Cutters, do	3 00 a 3 50

OUTSIDE BLINDS.

Up to 2.10 wide, per lineal foot	24 a —
Up to 3.1 wide	26 a —
Up to 3.4 wide	28 a —

INSIDE BLINDS.

Per lineal foot, 4 folds, pine	53 a — —
Per lineal foot, 4 folds, ash or chestnut	— 77 a — —
Per lineal foot, 4 folds, cherry or butternut	— 96 a — —
Per lineal foot, 4 folds, black walnut	1 08 a — —

The feeling of affliction and sorrow to which the people have lately been subject is gradually giving way to resignation; the incoming of the new administration has caused no unfavorable ripple to appear upon the surface of the commercial or financial situation; croakers are at a discount, and the very general expression is one of hope and cheerfulness, which infuses a more healthy feeling into all business circles.

REVIEW OF THE MARKETS.—In the lumber market trade has been rather slow during the past month taking the general run of the market, but if anything there has been a development of greater strength, and a higher range of values is looked for during the present month in many cases. The material addition to the cost of transportation would alone lead to this result, but every day has shown buyers that manufacturers and all sellers at primary sources are quite indifferent over the demand from this section unless accompanied by bids at extreme rates. Holders of attractive supplies therefore have gained confidence and offered with a showing of considerable indifference.

In the brick market common hards have shown marked improvement during the month, and we find not only a quicker and more satisfactory movement at higher prices, but a general cheerful feeling prevailing.

In the lime market trade has been active, and while prices have declined somewhat since our last report, they show at this writing quite a firm tone.

In the lath market there has not been much change in the situation, and no new features worthy of note are suggested. Consumption during the month has been good and promises to remain so.

In the hardware market demand has been very good in a general way, and some dealers report quite decided animation with every evidence of further improvement at hand. Local wants have been quite liberal and of a character to cover a large assortment of goods, while from the interior the call has come freely and is of daily growth. The offering of stock has not increased, manufacturers experiencing much difficulty in keeping pace with orders on standard goods, and naturally values have been strong all around.

In the metal markets American pig has had a firm tone, and with some sellers there has been quite a decided showing of indifference about entering into contracts except at extreme rates. A large business has been done in a quiet way and still continues, and offerings certainly are reduced. Scotch pig has increased somewhat in value and the market ruled pretty firm throughout, but at the higher cost consumers have appeared to move with caution. Importations have been light, and it is expected they will be kept down to a small compass for sometime to come. Manufactured iron has been in good general demand and the market has hardened, if anything, with some of the stock held at an advance. Mills are all full of work. Domestic pig lead has been in good demand for prompt delivery at full rates, and while some shading would probably be made on parcels to arrive the general tone of the market has been cheerful. Pig tin has become closely concentrated in the hands of dealers, and held with much strength and confidence. Demand is not very active at the present writing, but there appears to be an expectation of improvement before long. Tin plates have secured a fair distribution in small lots, and the market generally has ruled firm for all leading grades. Sheet zinc has met with an average demand and ruled about steady.

In the paint trade there has been a good steady outward movement of supplies and the general prospect is encouraging for a still further increase, and the tone of the market has remained strong throughout. Dealers seem to think the supply in the country is very light, in quantity, and assortment and must be made good.

Home Department.

Heat-Saving and Ventilating Fire-Place.

We illustrate and describe herewith a combined heating and ventilating apparatus which appears to us to include a number of highly meritorious features. The device is known as Jackson's Heat-Saving and Ventilating Grate, and combines the double functions which are indicated in its name, in a manner at once simple, rational and effective. The apparatus is shown in our engravings in two aspects, Fig. 1 being a front and Fig. 2 a rear view. The apparatus, when in place, has the appearance of an ordinary open grate, which can be made more or less ornate, as the taste of its owner may dictate. By an inspection of Fig. 2, however, it will be seen that it has a double shell, providing a space between the two for the circulation and warming of air, and its passage into one or several apartments of the house. The inner shell is that against which the fire rests. The outer shell lines the brickwork of the fire-place, and is seen partially in place in Fig. 2. The inner shell is provided on its back with a large number of projecting spurs or spikes, which increase its radiating surface, and serve as conductors to convey the heat rapidly away to the air currents traversing the air chamber included between the two shells. The superficial area of the heating surfaces facing the air chambers, and upon which the inflowing current of fresh air comes into contact in its passage, amounts, in the smallest size grate, to about 15¾ square feet, and in the largest size to 23½ square feet.

From this construction, therefore, it will be apparent that we have here an air-warming and circulating apparatus, combined with an open grate, in such a manner, that while the latter gives out to the apartment by direct radiation all the heat that is commonly afforded by the open fire-place, a large amount of additional heat which would otherwise be passed up and out at the chimney, is abstracted from the heated products of combustion, and from the back and sides of the fire-place by the cool air which enters from beneath the grate through suitable openings provided for the purpose, and passing upward through the heating chamber between the shells of the grate, is delivered in the form of a constant current of heated air into the apartment through the openings in the register across the top of the grate, or passed wholly or in part to an upper apartment through a suitable hot-air flue controlled by a damper that may be provided for the purpose if desired. The action of this fire-place will perhaps be better understood by consulting the cuts. Pure air is admitted from outside the building through the fresh-air duct seen in Fig. 2, from which it enters a chamber directly under the fire. From this it passes upward through the heating chamber between the shells of the fire-place and which surround the sides and back of the fire. From this it passes over the top of the fire-place between the flues which carry off the combustion products, and is delivered in a constant current more or less highly heated, according to the intensity of the fire, into the chamber through the register over the top of the grate. It is obvious that the currents of heated air thrown into the apartment in the manner described, are in addition to the heat derived by direct radiation from the fire; and they not only represent a material economy of heating effect which would be ordinarily passed out at the chimney, but materially assist the ventilation of the apartment. The apparatus seems to fill very fully all the conditions of a perfect ventilator, since the air entering directly from out-doors into the heating chambers, passes thence into the room, bearing a temperature at least double that of the air of the lower levels of the room, and hence rises directly to the ceiling, filling the room thus from above downwards with a pure, warm atmosphere. At the same time, the regular draught of the grate takes out of the room from near the floor about 150 cubic feet of the colder, vitiated air, and passes it out through the heated chimney flue into the open air. Another advantage of this grate, is that this supplying to the room an amount of air equal to the exhaust of the chimney, prevents all those draughts of cold and impure air from the crevices about the windows and under doors (communicating to other parts of the house), that are so objectionable in the workings of the common grate.

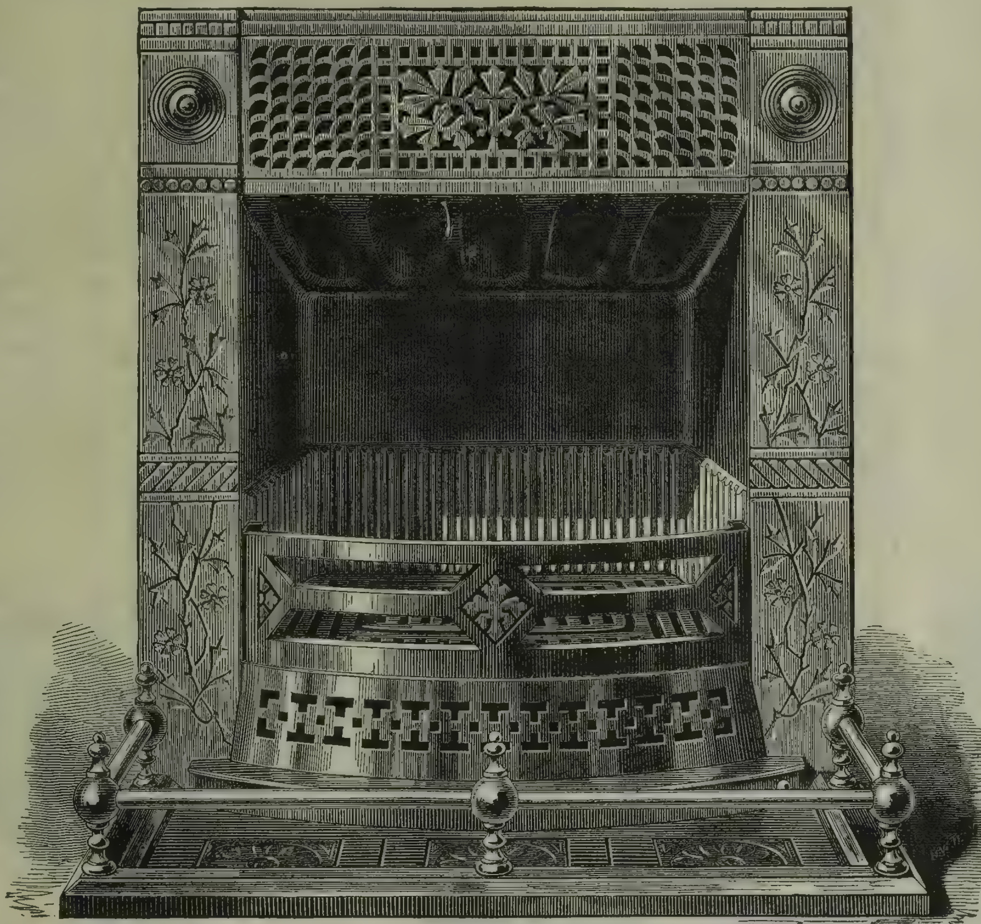


Fig. 1.—Jackson's Improved Grate—Front View.

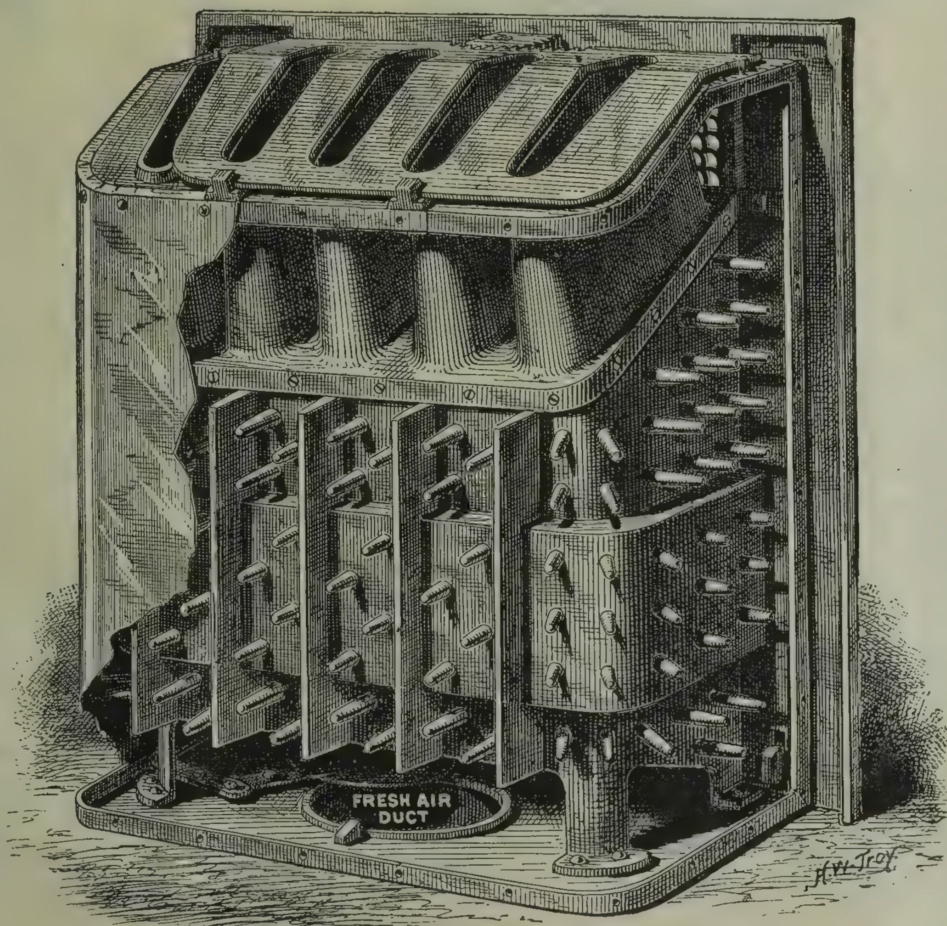


Fig. 2.—Jackson's Improved Grate—Rear View.

The constant passage of the cool air around the back and sides of the fire-place has the additional advantage of lessening the liability of the cracking and warping of the fire shell.

There are no joints for the leakage of gas into the air chamber, the upper portion of the framework, with its tubes, being cast solid in one piece. The heating and ventilating capacity of these fire-places has been repeatedly tested, and found to be much superior to those of ordinary construction, a conclusion that would be reached by any intelligent reader of the preceding de-

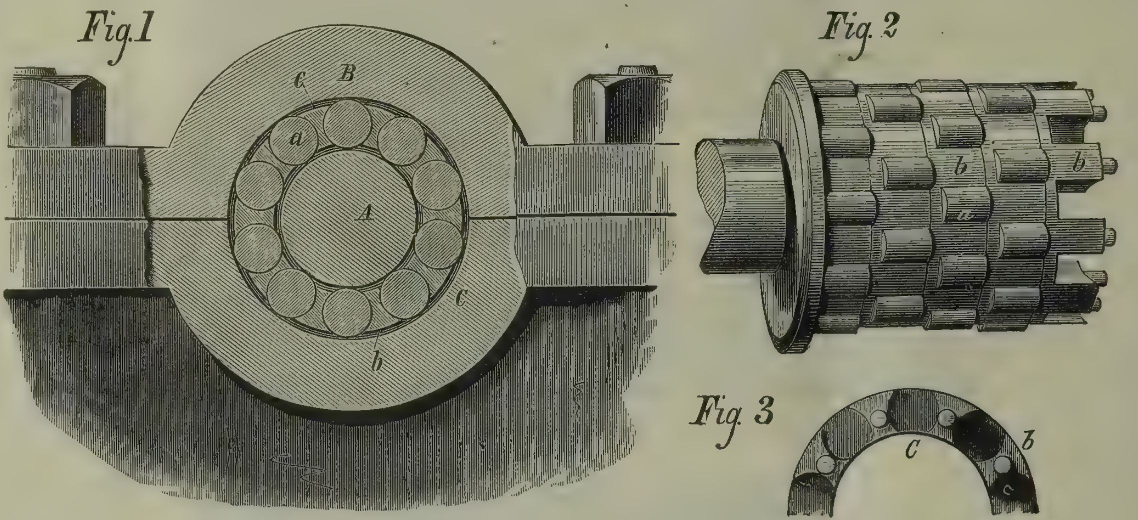
scription. The makers claim for their fire-place the following combination of desirable features: 1st. Beauty of design, excellence of workmanship, and durability of material. 2d. The property of the generous old-fashioned fire-place for imparting a cheerful, comfortable and healthful radiant heat to rooms, combined with a conservation of a large part of the heat that is usually lost in the chimney, and which is equal to three times the amount of that usually received from direct radiation. 3d. The capacity to secure in large rooms an equable and comfortable temperature in all parts, with no perceptible draughts from the doors or windows. 4th. The power to maintain always a supply of pure, warm and constantly changing atmosphere in dwellings.

For descriptive circulars, apply to Edwin A. Jackson & Bro., 315 East Twenty-eighth street, New York.

An Improved Anti-Friction Bearing.

The annexed engravings represent an improved anti-friction bearing, invented and manufactured by John G. Avery, of Spencer, Mass., and which is designed for use with shafting, carriages, team wagons, cars, etc. It is claimed that this device acts so perfectly that no lubricants are required, and "hot boxes" where these bearings are applied are affirmed to be impossible.

The accompanying engravings represent the device in three aspects, and will be understood from the following description, the reference letters being the same in all the cuts: A represents a journal of hardened steel, which revolves upon the hardened steel rolls *a*, situated in the shell *b*, and the whole working in the box B, which is lined also with hardened steel. The shell containing the rolls is so arranged, that in the six rows no two of the rolls are in the same line. This disposition is shown in Fig. 2. In action, therefore, the journal revolves entirely upon these rolls, by which means the friction is reduced to a minimum.



Improved Anti-Friction Bearing.

This bearing has been successfully applied to shafting, heavy team wagons, road wagons, expressmen's trucks, paper-mill rag engines, circular-saw arbors, miners' drilling machines, bicycles, tricycles, etc.

The invention is represented to have had the longest and most thorough test for shafting, carriages and team wagons, for which it has been found to give the utmost satisfaction. The maker represents the success of this device to be due to the special construction of the shell which holds the rolls and keeps them in place, and to the properly hardened surfaces—the rolls, journal and box all requiring to be hardened.

The maker further adds that he has devised special machinery for constructing this device economically and a special process for hardening, and claims that there is no instance in which a rotary motion is desired, but that, by the use of these bearings, at least one-third of the power can be saved.

Miscellaneous and Advertising.

The George Place Machinery Agency, of 121 Chambers street, this city, have always on hand a large line of new and second-hand machinery of every description.

Figured quarter-scale plans and elevations; large details; specifications and bill material of $1,000 house, for $2. Architect Camp, 1242 Third avenue, New York.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of 64 pages. Published by Jas. F. Hotchkiss, 84 John street, New York. Mailed free to any address.

Goodell & Waters, of Philadelphia, recently shipped one of their latest improved wood planers to Amsterdam, Holland. This firm find a constantly growing foreign demand for their machinery.

We call attention to the card of James C. Stead, of 65 Kent street, Greenpoint, N. Y., in our advertising columns. The fact that Mr. Stead has 15,000 horse-power of his circulating generators and feed-water heaters in use, speaks better for the merits of his economizing devices than anything else can.

Salicylized paper, made by dipping a suitable soft paper in a bath of salicylic acid, and subsequently drying it, is said to have been found very serviceable as a preservative wrapping-paper for fruit intended for shipment or lengthy storage. The bath should be made from a strong alcoholic solution of salicylic acid, diluted with just so much water as it will bear without precipitation.

Reed's covering for steam pipes, boilers and water pipes possesses the requisites of a perfect non-conductor, besides being very cheap and durable. Steam users should send to J. A. Locke & Son, 40 Cortlandt street, New York, for their circular containing all needful information respecting this really valuable material.

The Leffel Improved Turbine Water-Wheel in its present state of perfection, is superior to anything in the market. Parties contemplating any sort of improvement of water power, requiring new water wheels, should not fail to write the manufacturers at once for information, and for their fine, new, pocket, water-wheel pamphlet of 160 pages, which will be sent free. Address James Leffel & Co., Springfield, Ohio, or 110 Liberty Street, New York City.

The Johns Hopkins University of Baltimore.

This university affords admirable opportunities to college graduates and professional specialists to pursue more advanced studies, or to carry out special researches. In this year's programme we notice that the trustees call particular attention to the opportunities which their university affords for the prosecution of advanced studies in various branches of pure and applied mathematics and in physics. One feature of the programme that has been mapped out, will be the participation of Prof. A. Cayley, D.L., etc., Sadbrian Professor of Pure Mathematics in the University of Cambridge (England), in the course of instruction at the Johns Hopkins University, from January next, when he is expected to arrive in this country, until the close of the session in June. Besides giving lectures to mathematicians, Prof. Cayley, in conjunction with Prof. Sylvester, will conduct a mathematical seminary composed of the instructors and more advanced students of mathematics for the presentation and discussion of papers or oral communications. Other instructors who will deliver special courses of lectures on mathematical subjects, are, W. E. Story, Ph.D.; Thomas Craig, Ph.D., of the U. S. Coast and Geodetic Survey; and F. Franklin, Ph.D. The physical laboratory, well equipped with instruments of precision, especially with such as are adapted to researches in heat, electricity and magnetism, will be in charge of Prof. Rowland, Ph.D., and C. S. Hastings, Ph.D. Lectures on logic, and the methods of Science will likewise be delivered by C. S. Peirce, A. M., of the U. S. Coast and Geodetic Survey.

Design for Cottage Costing $5,500.

The cottage shown on the opposite page, now in process of erection, has many admirable features which will doubtless commend themselves to our readers. The principal entrance is on the side of the house, the doors opening into a large square staircase-hall with open fire-place. At the right of the hall is the parlor, back of which is the sitting-room or library—an arrangement that gives to both rooms the most desirable position with regard to a commanding westerly prospect and at the same time gives to parlor, sitting-room and dining-room a southerly exposure. All the rooms on this floor have open fire-places and there is no lack of closets.

The bedrooms on second floor are all of good size, and well supplied with closets.

The cellar runs under the entire house, one portion of it being partitioned and fitted up as a laundry.

The first story of this house is a dull-red brick laid up in red mortar. The second story is shingled—the shingles being shaped and having a very slight red stain and oiled. The roofs are slated with a very dark purple slate.

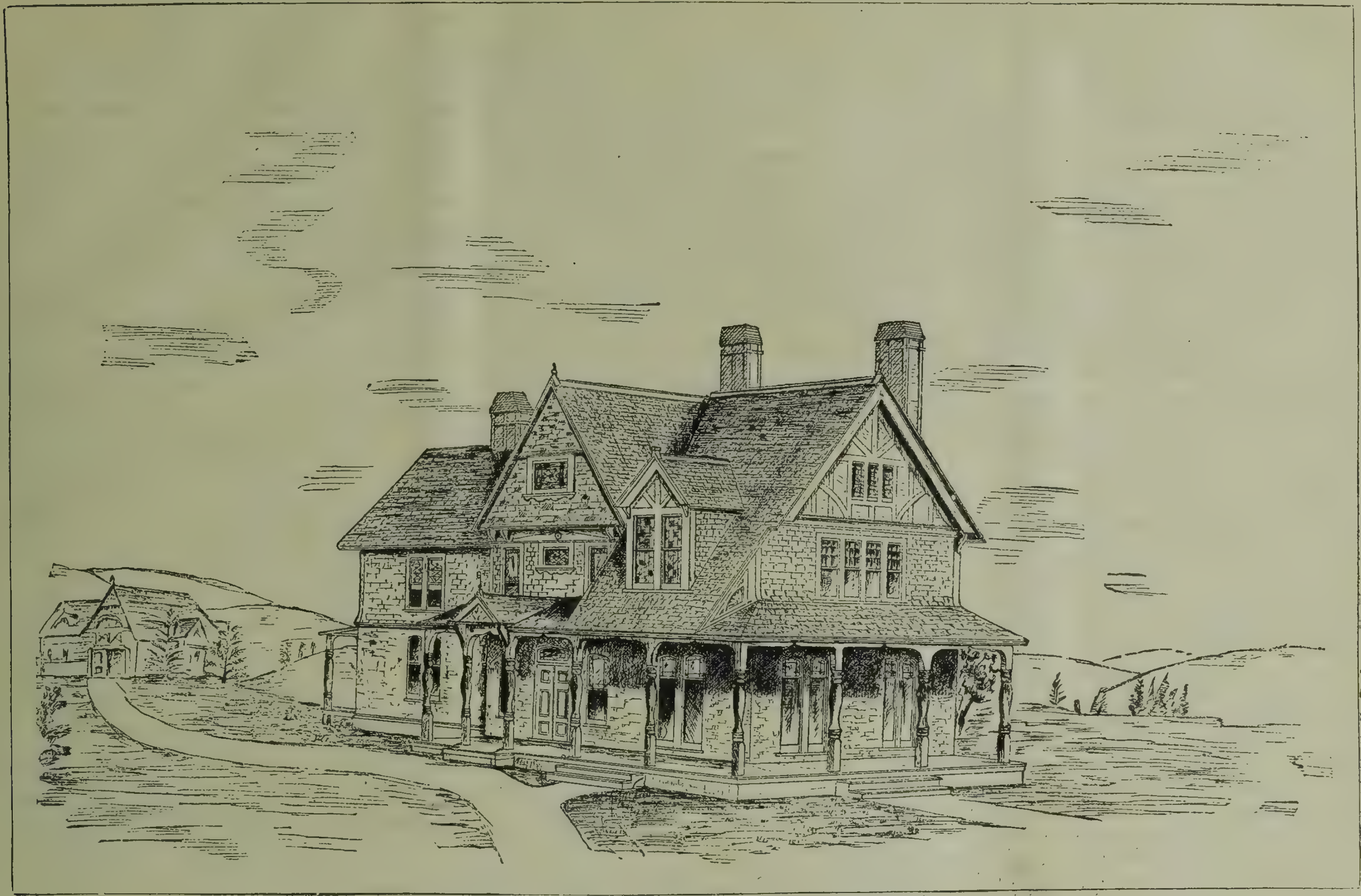
Stained glass has been judiciously used with a view to decorative effect, and the painting of the house inside and out has been made a matter of special attention.

The woods used in the interior are principally yellow-pine and ash. The staircase hall is all fitted up and floored in oiled yellow-pine.

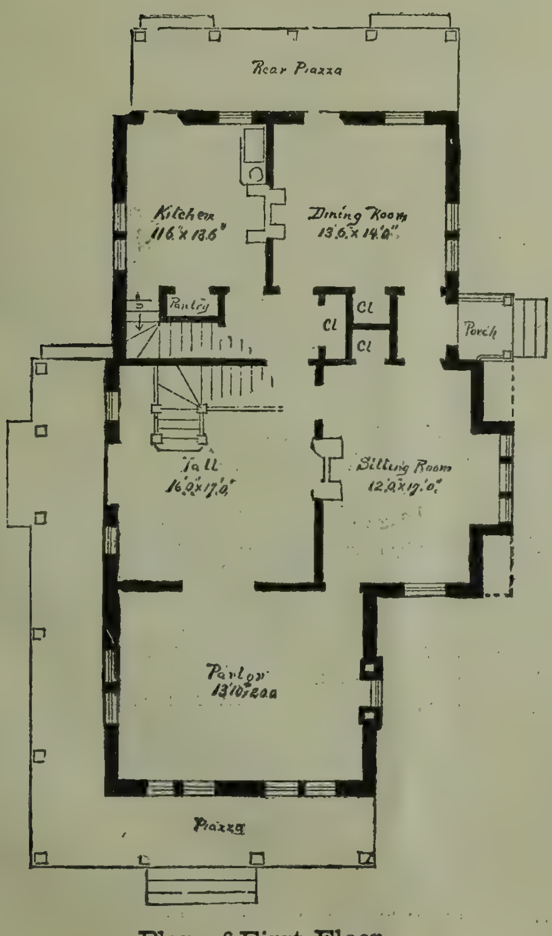
The sizes of the various rooms are as follows: On the first floor, a kitchen, 11 feet 6 inches by 13 feet 6 inches; dining-room, 13 feet 6 inches by 14 feet; sitting-room, 12 feet by 17 feet; parlor, 13 feet 10 inches by 20 feet; hall, 16x17 feet. On the second floor, are five bed-rooms of the following respective dimensions: 13x21 feet; 10x13 feet 6 inches; 12 feet 6 inches by 18 feet; 11x16 feet; 8 feet 6 inches by 11.

The architects are Smith & Howe, 7 Warren street, New York.

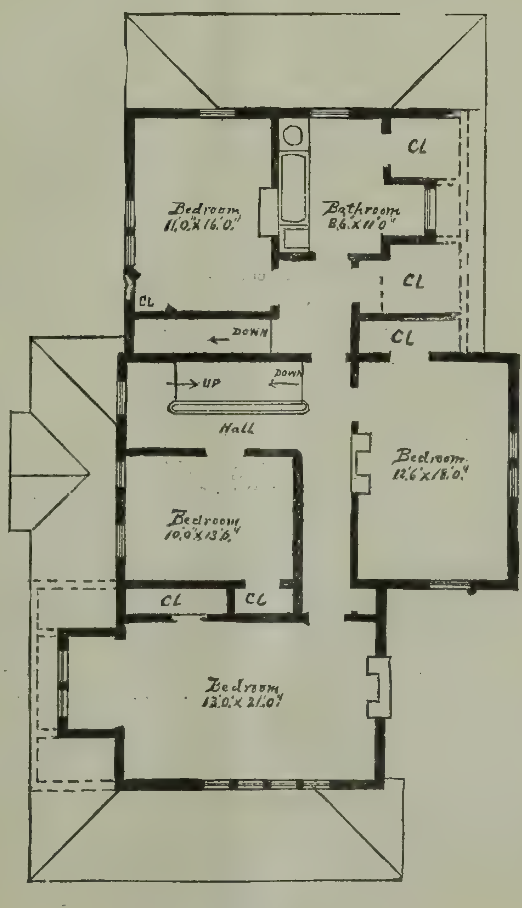
TO CRYSTALIZE GRASSES AND FLOWERS.—Dissolve six ounces of alum in one quart of water, and boil until dissolved; then steep the grasses or flowers in the solution while hot. If, by the time the water is cold, the crystals are too large, then add more water. Separate the little branches gently, taking off the superfluous lumps. Fern leaves, oats, flax and the long feathery grasses are the most beautiful for crystalizing.



DESIGN FOR COTTAGE, COSTING $5,500.



Plan of First Floor.



Plan of Second Floor.

Koumiss.

In the treatment which our lamented President received, our readers are aware that "koumiss" played an important rôle; and it may be of interest to give a few statements concerning this substance as an article of diet for invalids, for whom it appears to be singularly well adapted.

The original koumiss is a fermented drink prepared by the Tartars from mares' milk, fermented by a peculiar native ferment. It is a refreshing, effervescent drink, very pleasant to the taste, highly nutritious and readily assimilable even when the stomach rejects every other form of nourishment. On these accounts it has long been held in the highest repute by the Russians as a diet for invalids, and a number of establishments where the koumiss cure is practiced exist in that country. It is only within the past four or five years that the attention of American physicians and pharmacists have been directed to this substance, but its great value as a curative agent has only very lately come to be properly appreciated.

The *American Journal of Pharmacy* contained articles descriptive of the Tartar koumiss prepared from mares' milk, as early as 1874 and 1875, but the substance attracted little attention until last year at the meeting of the American Pharmaceutical Association, where its merits were very fully discussed, and several methods of preparing it were described. Dr. L. Wolff, of Philadelphia, at that meeting gave an interesting account of his experience in experimenting with various methods of manufacturing this material. His earliest experience he detailed as follows: "In 1876, I formed the acquaintance of a Russian gentleman, visiting the city, who had made koumiss in his native country, and together we experimented, but with very indefinite results, until we imported, at considerable expense, some of the original ferment from Russia, and with it prepared koumiss, which certainly effervesced very much, had a rich, creamy appearance, did not coagulate in heavy curd, was slightly acidulated, but possessed a rank, acrid taste, which I attributed to the ferment, whose odor was certainly not very inviting. The consequence was that the koumiss, which had been made at a considerable outlay, never enjoyed the reputation it ought to have acquired, and the costly ferment was gradually left to die out." From an investigation of the nature of koumiss, he concluded that its peculiar qualities must be largely due to "the nutritious quality of the milk, along with the alcohol produced by the fermentation of its sugar, while its rich effervescence makes it readily digestible, even to weak and enfeebled stomachs. The cause of success in its manufacture from mares' milk is undoubtedly due to the large amount of sugar of milk contained therein, which is 80 parts in 1,000 to 40.37 in cows' milk."

He observed, in his experimental attempts to imitate koumiss, that the sugar of milk, when added to cows' milk, is not readily induced to enter into fermentation by the common yeast fungi, on which account he substituted grape sugar for it. As milk sugar changes into grape sugar before undergoing vinous fermentation, there was no reason to fear that this substitution would in any way injure the quality of the resulting product. The grape sugar, in fact, yields by fermentation the same results as would be obtained by the sugar of milk—namely, carbonic acid gas and alcohol.

But in his earlier experiments, he found that his koumiss had an unpleasant tendency to curdle and become sour. The cause and remedy of this objectionable feature he succeeded in discovering and applying. To use his own words: "As I was inspecting one day the fermenting rooms of one of our large breweries, I was struck by the low, icy temperature maintained there, and on inquiry, was informed that if the temperature were allowed to rise, the fermentation would be sure to prove 'wild'—signifying sour or acetous fermentation. This showed me at once the reasons of my former failures, and when I applied the principle involved to my own koumiss, I had the satisfaction of drawing from my bottles a rich, creamy, homogeneous liquid, slightly acidulated, foaming like the choicest soda water."

Dr. Wolff concludes his paper with the following recipe for making koumiss, which he has found to yield excellent results. This recipe we have already published in an earlier answer to a correspondent, in our department of "Notes and Queries," but as the subject just now is one of general interest, it will bear repetition. We can vouch, from personal trial, that the result will be very satisfactory, if the formula is strictly followed. It is as follows: "Take of grape sugar, ½ ounce, and dissolve in 4 ounces of water. In about 2 ounces of milk dissolve 20 grains of compressed yeast (obtained at any grocery store) or else well-washed and pressed-out brewers' yeast. Mix the two in a quart champagne bottle, which is to be filled with good cows' milk to within two inches of the top; cork well, and secure the cork with strings or wire, and place in an ice-chest or cellar, at a temperature of 50° Fah., or less, and agitate three times a day. At the expiration of three or four days, at the latest, the koumiss is ready for use, and should not then be kept longer than four or five days. It should be drawn with a champagne siphon-tap, so that the carbonic acid gas may be retained and the contents will not entirely escape on opening the bottle."

The Route through the St. Gothard Tunnel.

The *St. James' Gazette* says that the railroad is so rapidly approaching completion, that a table of the fares to be charged on it is printed in the last edition of Meyer's "Guide-Book to Switzerland," in anticipation of the line being very shortly—in part at all events—open for traffic. Starting from Rothkreuz, 11 miles from Lucerne, the St. Gothard line runs along the western shore of Lake Zug, around the base of the Righi and by Lake Lowerz, striking the Lake of Lucerne at Brunnen. From Fluelen the line begins to ascend the valley of the Reuss, attaining an altitude of 1,558 feet above the level of the sea at the village of Erstfeld, 5 miles from Fluelen. Up to this point, the gradient of the line nowhere exceeds 10 in 1,000; but from Erstfeld to the next station, Amsteg, it rises 26 feet in every 1,000. From Amsteg the line runs through a number of short tunnels and over a number of bridges to Gurtnellen, 8 miles from Fluelen, where it attains an altitude of 2,427 feet. From Gurtnellen the line ascends the mountain side in a series of bold spirals, crossing the Reuss several times, and passing through the Pfaffensprung tunnel, 1,487 meters in length; and then, running through the Wattingen tunnel, reaches the station of Wasen, 3,008 feet above the sea level. Leaving Wasen, the line runs back again in the direction of Fluelen, then turning, passes through the Naxberg tunnel, 1,570 meters in length, and reaches the station of Göschenen. Here the St. Gothard tunnel—9½ miles long—begins.

Length of Telegraph Lines.

At the beginning of the present year there were in operation in this country 170,103 miles of telegraph lines, over which, during 1880, no fewer than 33,155,-991 messages were sent. About 30,000 miles of wire are in use on these lines, and the statement does not include the lines used exclusively for railroad business. The length of telegraph lines in the principal countries in which they are used, is tabulated thus:

	Miles.
United States	170,103
Russia	56,170
Germany	40,431
France	36,900
Austria-Hungary	30,403
Australia	26,842
Great Britain	23,156
British India	18,209
Turkey	17,085
Italy	15,864

New Publications.

Statistics of the American and Foreign Iron Trades in 1880. Annual Report of the Secretary of the American Iron and Steel Association, etc. James M. Swank, Secretary. Philadelphia: The American Iron and Steel Association. 1881.

The annual report of the able secretary of the American Iron and Steel Association for 1880, is the repository, as usual, of the most complete and reliable statistics of the iron and steel industries of the United States that we have. Mr. Swank has brought the machinery of his office, for obtaining the fullest details of these industries, to a high state of perfection, and the best evidence that he could ask that his industry and abilities are appreciated, is the unquestioned confidence with which his facts and figures are quoted at home and abroad.

We glean from the present report the following facts of interest respecting the iron and steel industries of the United States in 1880: Production of pig iron, net tons, 4,295,414; spiegeleisen (included in pig iron), 19,603; all rolled iron, including nails and excluding rails, 1,838,906; Bessemer steel rails, 954,460; open-hearth steel rails, 13,615; iron and all other rails, 493,762; total production of rails, 1,461,837; iron and steel street rails (included in above), 16,894; cut nails and spikes (included in all rolled iron), kegs of 100 pounds, 5,370,512; crucible steel ingots, 72,424; open-hearth steel ingots, 112,953; Bessemer steel ingots, 1,203,173; blister and patent steel, 8,465; all kinds of steel in 1880, 1,307,015; blooms from ore and pig iron, 74,589 net tons. Imports of iron and steel, $80,483,365; exports of iron and steel, $12,960,995; imports of iron ore, gross tons, 493,408; imports of steel blooms, net tons, 65,000; production of Lake Superior iron ore, gross tons, 1,987,598, anthracite coal, gross tons, 23,437,242; bituminous coal (estimated) 43,-000,000 gross tons.

General Description of a Thousand Dollar Cottage. By Architect Camp, New York.

The above comprises six sheets, giving working drawings, detailed specifications, and bill of materials complete for the construction of a cottage dwelling to cost $1,000. The sheets are comprehensive enough to be placed at once, without further explanation, in the hands of any intelligent builder to work from. They are the first of a series that this well-known architect designs to issue, to be placed at the disposal of any person desiring to use them, at trifling cost.

The sheets here referred to are six in number. Sheet 1 gives a general description of the $1,000 cottage, showing two views, one a front elevation and the other a section, with general instructions as to foundations, construction, etc.; sheet 2 continues the general instructions, and gives a view of the building in side elevation; sheet 3 contains general instructions, and gives a principal floor plan; sheet 4, the same, with a plan of second floor; sheet 5 gives a plan of cellar, with a bill of materials for the $1,000 cottage; and sheet 6 comprises various details, such as elevation and side views of window hoods, section and side of cornice, front and inside doors, various windows, outside steps, wood mantel, fire-place, etc.

A Portrait of Dr. Holland. Published by the Century Company, New York.

There is hardly a literary man in America whose writings have been more widely read than those of Dr. J. G. Holland, nor one whose name is better known among the people. It is said that nearly 600,000 copies of his books have been sold, to say nothing of the enormous sale each month of *Scribner's Monthly*, over which he presides as Editor-in-Chief. The Century Co., publishers of *Scribner's* (to be known as *The Century Magazine* after October), will soon issue a portrait of Dr. Holland, which is said to be a remarkably fine likeness; it is the photograph of a life-size crayon-drawing of the head and shoulders, recently made by Wyatt Eaton, and will be about the size of the original picture. It is to be offered in connection with subscriptions to *The Century Magazine.*

A Selection of Spiritual Songs for the Sunday-School. Selected and arranged by Rev. Charles S. Robinson, D.D. New York: The Century Co.

The publishers of Rev. Dr. Robinson's "Spiritual Songs for the Sunday-School" have just issued a little book containing only the hymns of that work, and selling for one-half the money. It will be a most desirable supplement to the large book, greatly increasing its usefulness, and placing it within the reach of the largest mission-schools. The new edition is prettily bound in flexible red cloth, and costs but twenty cents. The complete tune edition, bound in stiff boards, covered with red cloth, with red edges, costs forty cents to schools in quantities. It is said that the sales of the latter work have mounted up into the scores of thousands since its issue a year ago.

OTHER PUBLICATIONS RECEIVED.

Tariff Tracts, Nos. 1 and 2. Bottom Facts. A calm presentation of some of the foundation principles upon which the American policy of protection to home industry rests. By David H. Mason, of Chicago. The Testimony of the Fathers. Distinguished opinions of industry, labor, wages, foreign trade and protection. Philadelphia: American Iron and Steel Association, 265 South Fourth street.

Reports on the Grand Water-Ways of Pennsylvania, made by order of Congress, under the direction of the United States Corps of Engineers, in the years 1878, 1879 and 1880. Harrisburg: State Print. 1881. From Hon. James Gay Gordon, Philadelphia.

Northern and Western Boundry Commissions. Report of the Pennsylvania Board for the years 1879 and 1880. Harrisburg: State Print. 1881. From the same.

Report of the State Commissioners of Fisheries for the years 1879 and 1880. Harrisburg: State Print. 1881. From the same.

Statistics of the American and Foreign Iron Trades in 1880. Annual Report of the Secretary of the American Iron and Steel Association, containing Statistics of the American Iron Trade to January 1st, 1881, and a review of the present condition of the iron industry in foreign countries. James M. Swank, Secretary. Presented to the members July 30th, 1881. The American Iron and Steel Association, No. 265 South Fourth Street, Philadelphia, Pa.

Quarterly Report of the Chief of the Bureau of Statistics, Treasury Department, relative to the imports, exports, immigration and navigation of the United States, for the three months ended March 31, 1881; also containing other statistics relative to the trade and industry of the country. Washington: Government Printing Office. 1881.

The Albany Granite, New Hampshire, and its Contact Phenomena. By George W. Hawes. New Haven: Reprint from the American Journal of Science and Arts. From the author.

List of Premiums, Rules, Regulations, etc., of the Deseret Agricultural and Manufacturing Society, for the Fifteenth Exhibition, to be held in Salt Lake City, Utah, commencing on the third day of October, 1881. Salt Lake City: Herald Printing Company. 1881.

Correspondence.

UTILIZATION OF LIGNITE.

To the Editor of the Manufacturer and Builder:

If you have any readers who make apparatus for the extraction of pitch, etc., from lignite, I should like to have their address at once. Very truly, Robert Grimshaw.

Philadelphia, September 14, 1881.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2878) Executing Criminals by Electricity.—I have often wondered that, among the very numerous uses of electricity, it has never been suggested as a means of executing criminals condemned to die. It seems to me that it would be a very great improvement upon the present barbarous and brutal method of hanging by the neck, which is often bungled in disgusting fashion by awkward hands. It could be made, I believe, even more certain and speedy than the guillotine, which, though I regard as a preferable mode of putting criminels to death when compared with hanging, is too much like butchery to be appropriate for civilized people, when science can offer a better way. What do you think of these views? Do you agree with them?—J. M. E., St. Louis, Mo.

(2879) The Glass Industry in America.—When was the glass industry started in this country? and where was the first glass works located?—R. J. G., Pittsburgh, Pa.

(2880) Rendering Petroleum Non-Explosive.—Which is the simplest and best way for making poor or inferior kerosene safe?—W. F. H., Nashville, Tenn.

(2881) Depth at which Divers can Work.—What is the greatest depth at which divers can work with safety?—W. E. G., Galveston, Tex.

(2882) Natural Gravity of Oil.—What do you understand by the "natural gravity" of an oil being 25?—R. G., Philadelphia, Pa.

(2883) Early Uses of Anthracite Coal.—When was hard coal (I mean anthracite coal) first used in this country? and who first used it?—P. S. S., Brazil, Ind.

(2884) Wearing Qualities of Aluminum.—I have read with interest several articles in your journal on aluminum, but find very little in them about the wearing qualities of the metal for such domestic uses as spoons, for example. If you have any information on this point, please let me have it in your next number, and much oblige.—J. H., Salem, Mass.

(2885) Veneering.—How long has the art of veneering been practiced? Who originated it?—A. T., Rolla, Mo.

(2886) Linoleum.—Can you tell me anything about the floor covering called by the trade "linoleum"? what it is? and how it compares in wearing qualities with common oil-cloth?—W. B. R., Indianapolis, Ind.

(2887) Crystalline Surface on Card-Board.—What is the material used to produce the spangled surface on card-board, used for visiting-cards, etc.?—A. M. R., Newville, Pa.

(2888) Tinning Small Articles.—Please give us a simple and expeditious method for tinning small articles.—Z. A. & Co., Indianapolis, Ind.

(2889) Japanese Bronzes.—Can you refer me to any results of chemical analyses of the peculiar black bronzes exhibited by the Chinese and Japanese at the Centennial Exhibition?—R. H., Philadelphia, Pa.

(2890) Hecktograph Ink.—Please inform me how to make the purple ink used with the hecktograph.—J. A. G., Phoenixville, Pa.

(2891) Varnish for Imitating Gilding.—Can you give me a formula for a varnish that will imitate gilding on brass or bronze?—R. H., Philadelphia, Pa.

(2892) Rule for Thickness of Flanges.—Will you please give me a rule to find the thickness of flanges for a cast-iron pipe, when the pipe is used to convey water, or when used as a column. By doing so you will greatly oblige.—H. C. S., Camden, N. J.

REPLIES.

(2878) Executing Criminals by Electricity.—We entirely agree with our correspondent, that death by an electric shock would be a vastly more civilized mode of executing the sentence of death upon criminals than either hanging or the guillotine. It does its work certainly and instantaneously, and were it adopted, it would do away with the horrible brutality which so often accompanies a hanging superintended by a bungling sheriff's deputy. We think, too, the adoption of the electric method of executing the death sentence would have a wholesome moral effect upon the criminal classes who hold human life in cheap esteem. There is something awfully terrifying to the vulgar intelligence in this silent, mysterious and omnipotent agent; and we believe the adoption of the suggestion made in this inquiry would do more towards inculcating universally a profound regard for the sacredness of human life than all the other deterrent influences—educational, religious, or otherwise, combined. Our correspondent is wrong, however, in supposing that electricity has never been suggested as a means of executing criminals. The idea has frequently been suggested, and earnestly advocated, though as yet no strong, organized effort has been made towards securing the adoption of the method in any country. It is probable, however, that ultimately the electric method will be the one universally adopted among civilized people. There is another side to the question of the treatment of condemned criminals that we cannot pass by without comment. We refer to the notoriety that is almost universally given to the murderer by the newspapers, that pander to the unwholesome curiosity of certain classes, by spreading broadcast every sickening detail of the crime, every incident of the history of the criminal, his manner, his bearing, his sayings and doings, until the drunken ruffian who has kicked the life out of his wife, or the cowardly wretch who has poisoned another for gain, becomes a hero. Horrible as it may seem to us, this sort of notoriety is as dear to the heart, and as tickling to the vanity of many a vulgar assassin, as his good name is to a man of sterling worth. Even more disgusting to every right-minded man and woman, and almost as demoralizing in its influence, are the misplaced sympathy and solicitude of sickly setimentalists which the lax discipline of our prisons permits to be bestowed upon the hero in his cell, while the sorrowful survivors of his victim perchance are suffering for the necessaries of life. Last, and most offensive of all the perverted accompaniments of the judicial execution, is the last public appearance, on any stage, of the chief actor. The carefully rehearsed speech of the persecuted saint and martyr, who effusively forgives everybody; and then the final farce of a public religious service, preparatory to the closing tragedy. All these things seem to us to be wrong; all this notoriety, misplaced sympathy, and the publicity of the final performance, so far from teaching the wholesome lesson of fear for the awful majesty of the law, seem to us inclined rather to foster a spirit of emulation among the criminal classes and the hopeful youths who gloat over the details as they appear, with all the lavish adornments of illustration, in the pages of the police gazettes. The execution of the dread penalty of the law, should be surrounded by every circumstance calculated to inspire terror and respect for the awful majesty of the law. From the moment that the death sentence is pronounced by the lips of the judge, the condemned should disappear from the sight and knowledge of the world as completely as though the earth had opened and swallowed him up. No one should be allowed to see him save the officers of the prison, and perhaps a spiritual adviser; and when the time has come for him to pay the penalty of his crime, he should be killed by a stroke of artificial lightning, in the presence only of the few persons whose testimony is necessary to prove the fact that the sentence of the law has been carried out. The moral effect of such executions would be of service to law-abiding people.

(2879) The Glass Industry in America.—On the authority of Ball's "Industrial History of the United States," we may inform this inquirer that the first glass factory in this country was started in Virginia almost immediately after the founding of the first settlement. It is even reported that the very first cargo sent back to England contained "trials" of glass made in Virginia. The precise location of this primitive establishment is involved in doubt; but it appears, at any rate, that it stood in the woods about a mile from Jamestown, and that a portion of its product was in the form of glass beads, to be used in trade with the Indians. The same authority informs us that in 1621, a fund was raised to establish a factory especially for making glass beads. One glass factory of this kind is known to have been in operation in 1632, and it is probable that there were two. The next effort in this direction by the colonists was made in Massachusetts. Glass bottles, tableware and window glass were in universal demand, and the colonists were not contented with the slow and costly process of importing these wares from England. Factories were accordingly started at Braintree at a very early date, and at Salem in 1639. They were encouraged by the government of the colony of Massachusetts, and appear to have thrived for a long time. The one at Braintree remained in operation nearly down to the time of the Revolution. In Philadelphia a glass house is known to have existed in 1683, one year after the foundation of the city. New York city had two glass works as early as 1732. During the Revolutionary War, window glass was made in New Jersey, but of very inferior quality. After the close of the Revolution, the manufacture of glass was encouraged by both national and State governments, and a tariff of ten per cent was levied by the former on imported glass. In 1788, the Legislature of New York loaned £3,000 for eight years to the proprietors of a glass factory near Albany; and about 1803, Massachusetts voted a bounty to a factory in Boston for every table of window glass made. The manufacture was encouraged in Connecticut, Maryland and Virginia, and all of these States had small factories in operation before the beginning of the present century. The business began in Pittsburgh, Pa., in 1796, with the establishment of bottle and crown glass works by Gen. O'Hara. The factory met with great success, and is in operation even at the present day, though changed in name and greatly enlarged and improved. The success of this pioneer establishment inspired others to enter the business, and quite an impetus was given to it by the war of 1812, which raised the price of glassware very considerably; and as Pittsburgh was sufficiently remote from the scene of active hostilities to be safe from invasion, there were, by the close of 1814, five glass furnaces in operation in that city making bottles, window glass and tableware. One of these was the flint-glass works of Blakewell & Co., the pioneer of its class in America. The concern imported its workmen; it made sets of tableware for two Presidents, and also produced a splendid vase, which was subsequently presented to Lafayette. Since then, the glass manufacture in the United States has been greatly developed, the chief localities of its manufacture being the States of Pennsylvania, New York, New Jersey, Ohio and Massachusetts. The total value of glass articles manufactured yearly in this country is approximately $30,000,000. There is still room for further expansion, for although the production of bottles, tableware, lamp chimneys and common window glass is sufficient to meet the demands of the country, the higher grades of manufactured glass are still largely imported from Europe.

(2880) Rendering Petroleum Non-Explosive.—There is no way by which poor or inferior kerosene can be rendered safe for the purpose of burning in lamps, which we infer to be the object of our inquirer's question. Our inquirer should remember that the great danger in using inferior petroleum oils, arises from the ready volatility of the inferior oils with which the kerosene has been adulterated, and the extreme inflammability of the vapors given off, and their explosibility when mingled in proper proportions with air. A few words respecting crude petroleum and the method of refining it, will convince this inquirer of the impossibility of effecting what his question asks. Crude petroleum consists of an intimate mixture of a large number of oils, which are roughly separated by fractional distillation, in retorts at the refineries, into about a half dozen commercial products. The apparatus employed is an iron still, provided with a worm of wrought iron pipe submerged in a tank of water for the purpose of cooling it. When the still has been filled with crude oil, the fire is started, and the distillation commences. The first products that escape are gases; they pass through the coil and escape without being condensed. If it is desired to retain these products, it may be accomplished by surrounding the coil and receiver with ice, or by compression with an air pump into a strong receiver. By these means certain very volatile liquids are obtained, called rhygolene and chymogene. The vapors soon begin to condense in the coil, and a stream of oil trickles from its far end into the receiving tank. The first oils have a gravity of about 95° Beaumé, and as distillation progresses the product becomes heavier—90° B., 85° B., 80° B., and so on. The different commercial products of petroleum are produced by collecting the products of distillation between certain gravities, into separate tanks. Thus, in most establishments, it is customary to allow the first distillate—the most volatile product—to run into one tank, until the gravity of the product reaches about 60° B. This product is called crude naphtha, and is separated by subsequent redistillation into (1) gasolene, the lightest; (2) naphtha; and (3) benzine. When the stream of oil has a gravity of about 60°, it is diverted into the kerosene tank, and continues to run into this receiver until the gravity reaches about 38° B. This second fraction is the burning oil or kerosene. The stream of oil after this second fraction has been taken off, is directed to the paraffin oil tank, and is allowed to continue until nothing remains in the still but coke. From this third fraction the solid paraffin is obtained by chilling and the application of hydraulic pressure, and the oil expressed from it is known as lubricating oil. The foregoing represents the general practice of refiners, but special products are sometimes made by modifying the fractioning operation. The kerosene forms the heart of the crude oil, and comprises about 55 per cent of the volume of the crude material. It is specially adapted for illuminating purposes in ordinary lamps; first, because it has been freed from the lighter and more volatile portions of the oil, which are highly dangerous, by reason of the low temperature at which

they are vaporized, and their extreme inflammability and explosibility when mixed with air; and secondly, because it has been freed from the heavier portions of the crude oil, which are troublesome to burn freely by reason of clogging the wick. Kerosene should only commence to give off vapor at 100° Fah., and should not take fire below 110° Fah. An oil that will stand this test—and all kerosene should stand it—is practically safe in the ordinary lamps. The addition, however, of even a trifling quantity of the lighter oils to kerosene, will very materially reduce the flashing and burning point of the oil, and will render it dangerous to use in lamps. The cheapness of the naphthas make it a standing temptation to dishonest dealers to practice this species of adulteration in spite of stringent laws in existence for its prevention. From this brief history of the preparation and properties of commercial petroleum products, our correspondent will perceive how absurd it is to suppose that the addition of any substance to a kerosene adulterated with benzine or naphtha can make it safe. No treatment that such adulterated oil can be subjected to, short of the complete elimination of the volatile portions by redistillation, can be of any avail in depriving the volatile portion of its volatility and inflammability, which are the dangers to be feared from such mixtures. When such adulterated oils are used in lamps, the body of the lamp is soon heated, and the heat is communicated to the oil within it, causing the light and easily volatilized portion to vaporize and escape through the opening provided by the wick tube; or the vapor may find some resistance to its escape, and may accumulate until it has acquired sufficient tension to blow out the cap and cause a violent explosion. If a lighted lamp, filled with such adulterated oil, is accidentally overturned or broken, the volatile and readily inflammable portion will take fire from the burning wick, and everything on which it may have been spilled. Both of these classes of accidents are very common, and show how generally the adulteration of petroleum is practiced. No treatment, or addition of any kind, can change the nature of these volatile and highly dangerous oils; and all the nostrums that are advertised and vended for the purpose of making such adulterated petroleum safe, are rank impostures. We have several times given our readers the hint to subject their oils, on purchase, to one simple test, to assure themselves that it is safe, and we again repeat it: Pour about a tablespoonful of the oil into a saucer, or other convenient receptacle, and apply a lighted match to it. If the oil takes fire, reject it; if the oil puts the match out, it may be used without fear of accident.

(2881) Depth at which Divers can Work.—With the aid of the most approved appliances that have thus far been devised, divers can safely descend to a depth of 160 feet beneath the surface of the water; but at this depth it is impossible to remain more than a quarter of an hour, or thereabouts, at a time. This is owing to the enormous pressure to which they are subjected at great depths, and which speedily produces great discomfort, and frequently serious results, if the experiment of descending to such extreme depths is often repeated, or the stay of the diver is too much prolonged. To enable him to move about with freedom at this depth, it is necessary to dispose a weight of 1 cwt. about the person of the diver. The average depth at which he can work comfortably is about 90 feet. In water from 60 to 70 feet deep the men can work for two hours at a time, coming up at the expiration of this time for ten minutes' rest, and performing a day's work of six or seven hours. Mr. Henry Siebe, in his entertaining volume entitled "The Conquest of the Sea," reports the case of a Liverpool diver named Hooper, who descended to a vessel sunk off the coast of Chili, and which was lying at a depth of 34 fathoms (204 feet). He reports this as an exceptional case, and states his belief that this is the greatest depth that any diver ever descended in a diving dress. The diver here referred to descended seven times in all, and one time remained over 40 minutes. The same auther reports the case of an English diver in an improved diving dress, who went down in the Mediterranean to a depth of 165 feet, and remained there for 25 minutes; and he alludes to the case of Green, an American diver, who inspected a wreck in one of the great lakes at a depth of 170 feet, but his experience was enough to convince him that he could not work without danger to life. At this depth the pressure of the water on the hands is so great as to force the blood to the head and bring on fainting fits, while the requisite pressure of air inside the dress to resist the pressure of the external water, is so great that it can only be borne safely for a very brief period. Numerous efforts have been made to obviate these difficulties, but for the present a limit has been set to the extent to which man may penetrate the secrets that the deep conceals. It is easy to comprehend the serious dangers to which divers subject themselves at great depths. In various engineering works, where men are working in caissons or tunnels under air compressed perhaps to 2 or 2½ atmospheres, they frequently suffer at first from very distressing symtoms until they have become accustomed to the change. The difficulties encountered by divers at great depths are vastly greater. The ordinary atmospheric pressure distributed over the entire body (6,000 square inches for a man of average size) is about 90,000 pounds. But the air and fluids of the body resist this pressure with an equal and opposite one, so that we are not aware of the weight of the atmosphere that is pressing upon us. Not so, however, with the human body immersed in water, for then the pressure is all external. A column of water 32 feet high will exert a pressure equal to that of the atmosphere—about 15 pounds per square inch—or for the whole surface of the body—90,000 pounds. At a depth of 32 feet, therefore, the body must support this pressure in addition to that of the atmosphere, and at every additional 32 feet of descent 90,000 pounds more must be borne. At the depth of 160 feet, therefore, the unprotected body would be called on to support the immense pressure of 450,000 pounds, equivalent to a pressure of 5 atmospheres. It will require no explanation to understand that, though modern diving apparatus measurably protects the breathing organs, no portion of the body can long be exposed to such abnormal conditions for any length of time without dangerously affecting the circulation and other vital processes.

(2882) Natural Gravity of Oil.—The only explanation of this peculiar expression that we can conceive, is that it has been used by some unscientific person to indicate the gravity of a natural oil—that is, a crude oil, previous to undergoing the process of manufacturing or refining. It is probably intended to mean in this case that the particular oil referred to, in the crude state had a gravity of 25° Beaumé.

(2883) Early Uses of Anthracite Coal.—P. W. Sheafer, of Pottsville, Pa., a mining engineer, who has given much attention to the history and development of the anthracite coal industry of Pennsylvania, is our authority for the following historical and commercial points of interest in relation to the subject of our inquirer's question, viz.:

1768—Anthracite coal was first used in the Wyoming valley, by Obadiah Gore (blacksmith).

1775-1776—Several boat-loads of anthracite coal were sent from Wyoming down the Susquehanna river, and thence hauled to the military barracks at Carlisle, Pa., to be used in the manufacture of arms.

1790—First coal known in Schuylkill county.

1794—Blacksmiths used it in Schuylkill county.

1808—Used in grates by Judge Fell, of Wilkesbarre, Pa.

1812—Col. George Shoemaker hauled nine wagon-loads of coal from Pottsville to Philadelphia, and gave away the coal.

1814—Charles Miner sent an ark-load (24 tons) of coal from Mauch Chunk, Pa., *via* the Lehigh and Delaware rivers, to Philadelphia.

1815—Schuylkill navigation commenced.

1825—365 tons of coal shipped by the Lehigh canal.

The canal trade of the Lehigh region was opened in 1820; that of the Schuylkill region in 1822; and that of the Wyoming region in 1829. The annual product of the Pennsylvania anthracite colleries is now not far from 20,000,000 tons.

(2884) Wearing Qualities of Aluminum.—There is no objection to aluminum for such domestic uses as spoons and the like, on the score of its wearing qualities, which are comparatively very good. This fact has been experimentally verified by Herr Winkler, a German chemist. To test in practice the wearing qualities of aluminum, this chemist had made a number of spoons respectively of silver, pure aluminum and German silver. A spoon of each of the metals above named was accurately weighed on February 1, 1876, and all were put into daily use under precisely similar conditions for the period of one year. They were placed in the same soups, sauces, sour salads, and the like, and the servant whose duty it was to wash them, was given strict orders to clean them each in the same manner. The cleaning consisted substantially in wiping them with a woolen cloth, washing them in hot water, and then rinsing them in cold. Soda was often put into the hot water, and the spoons were thus daily subjected to hot acid and alkaline solutions. The color of all the metals altered in time—the aluminum lost its luster, and became of a dull, bluish-gray color; the German silver also degenerated to a grayish-yellow tint; the silver lost only in color, but its luster was not impaired. As regards mechanical abrasion, no marked difference was perceptible, although after a year's use the aluminum spoon showed distinct traces of wear at the edges. By accurately weighing the spoons at the end of the period named, the fact was established that the loss of weight suffered by the spoon of silver was 0.403 per cent; by the aluminum spoon, 0.630 per cent; and by the German silver spoon, 1.006 per cent. From the above facts, it appears for such domestic articles as spoons, aluminum stands wear very well, though not so well as silver.

(2885) Veneering.—The art of veneering originated about fifty years ago, and was most probably first practiced in England. It originated in the high price of the rare and beautiful cabinet woods. This fact, and the actual scarcity of varieties of the fine cabinet woods, suggested to some ingenious mind the idea of sawing up the logs of those rare and beautiful woods into thin sheets, and of covering furniture, doors, picture-frames, etc., made of cheaper woods, with these sheets of the rarer lumber, so as to produce the same effect as though the articles were made of solid cabinet woods, thus gaining the appearance without the cost of the more valuable material. It is, in fact, another application of the process extensively used in other branches of the useful arts of covering an inferior material with a superior one, as in gold and silver plating, glass-making, and the like. Though from a rigid artistic standpoint the use of veneers would not be approved, the high utility of the art has made their use absolutely indispensable, and its universal application has largely robbed it of the charge of being an attempt to palm off an inferior article for a superior one. No one supposes, for example, that a rosewood piano is made of solid rosewood; yet the rosewood veneer gives all the artistic effect of that very costly wood.

(2886) Linoleum.—We cannot answer with positiveness the question as to the composition of the fabric called linoleum. We have been informed, however, on what we regard as good authority, that it is made by covering strong jute cloth (burlap) with a mixture of linseed oil and cork powder, to which some mineral color has been added to form a ground on which the pattern is subsequently printed. The general process of manufacture is doubtless identical with that of oil-cloth. With respect to the wearing qualities of linoleum, we can speak from personal knowledge in terms of the highest praise. The material is elastic, accommodating itself readily to the irregularities of the floor on which it is laid, and is not liable to crack when laid down on a rough or uneven floor. In this respect it is greatly superior to oil-cloth, which is notoriously troublesome in this particular. This same quality—due, no doubt, to the elastic nature of the cork it contains—gives it excellent wearing qualities, in which respect also it is decidedly superior to oil-cloth. It will bear the roughest usage, and almost completely deadens the noise of footsteps. The material is without doubt excellently adapted for its intended use, and has come to be very generally introduced as a substitute for oilcloth.

(2887) Crystalline Surface on Card-Board.—The substance generally used for this purpose is the acetate of lead, commonly called sugar of lead; but inasmuch as it is poisonous, it is not to be recommended, as it is liable to become the cause of accidents. Better formulæ are the following, suggusted by the late Prof. Boettger, which afford a brilliant crystalline surface on wood, paper, etc.: Mix a very concentrated cold solution of salt with dextrine, and lay the thinnest possible coating of the fluid on the surface to be covered, with a broad, soft brush. After drying, the surface has a beautiful, bright, mother-of-pearl coating, which, in consequence of the dextrine, adheres firmly to paper and wood. The surface may be made adhesive to glass by going over it with an alcoholic shellac solution. Beautiful crystalline coatings may be produced on wood or on sized or glazed paper by the use of the following salts: Sulphate of magnesia, acetate of soda, and sulphate of tin. Colored glass thus prepared gives a good effect by transmitted light.

(2888) Tinning Small Articles.—Make a saturated solution of chloride of zinc, by dissolving zinc scraps in muriatic acid until the acid will take up no more. Allow the solution to settle, decant off the clear portion, and keep for use. Next take a strong iron vessel of suitable shape for your use, set it over the fire, place the tin therein and melt it. Then put on the surface as much mutton or beef tallow as will suffice to cover the molten tin to the depth of a quarter of an inch, taking care that the tallow shall not catch fire. This covering prevents the oxidation of the tin. The objects to be tinned must first be thoroughly cleansed of all scale or oxide, which is generally done best by immersion in dilute sulphuric acid. They should next be rinsed in fresh water, then dipped in the zinc solution, dried, and finally carefully immersed in the melted tin. The objects are quickly covered with a bright coating of tin, when they may be removed, and the operation is complete.

(2889) Japanese Bronzes.—By referring to the Journal of the Chemical Society of London, 1874, page 927, this correspondent will find the results of a chemical analysis of some of the Chinese and Japanese bronzes exhibited at a previous exhibition. These bronzes were characterized by having an unusually deep color. The peculiar appearance of these bronzes is attributed to the presence of a much larger percentage of lead than occurs in the ordinary bronzes with which we are familiar. An alloy composed of 5 parts of tin, 83 of copper, 10 of lead, and 2 of zinc, proved to be a very excellent imitation of the Chinese and Japanese bronze, and was identical with it in fracture and luster. When heated in a muffle, it quickly assumed the peculiar dead-black appearance so greatly admired in the Oriental bronzes.

(2890) Hecktograph Ink.—The following is said to be a standard formula for preparing the purple hecktograph ink: Dissolve 1 part of methyl-violet in 8 parts of water, and add 1 part of glycerine. Gently warm the whole for about an hour, then allow to cool and add ¼ part of alcohol. *New Remedies.*—A good authority, in speaking of this recipe, adds that the alcohol may be advantageously omitted, and that the following proportions will give even better results than the above, viz.: Methyl-violet, 1 part; water, 7 parts; glycerine, 2 parts. This formula, it is said, produces an ink which is less liable to sink into the paper.

(2891) Varnish for Imitating Gilding.—A very perfect imitation of gilding on brass and bronze articles, it is said, may be made by means of a varnish composed of 160 grains of gum-lac, 40 grains of dragon's blood, 10 grains of turmeric, and 3,320 grains of alcohol. The metal should be brushed with the varnish in all directions, by means of a sponge, and then immediately warmed over a gentle charcoal fire. The surface at first will appear dead, but will soon resemble the finest gilding. The varnish should be kept in well-corked bottles.

(2892) Rule for Thickness of Flanges.—We do not know that any general rule exists on this subject; but the *practice* for both cases referred to by our correspondent, is, we believe, to make the flange of about the same thickness as the pipe, with a view to prevent the weakness as well as the distortion, or warping, to which castings of different thickness in different parts are well known to be liable, owing to the inequality of time required for cooling.

THE MANUFACTURER AND BUILDER.

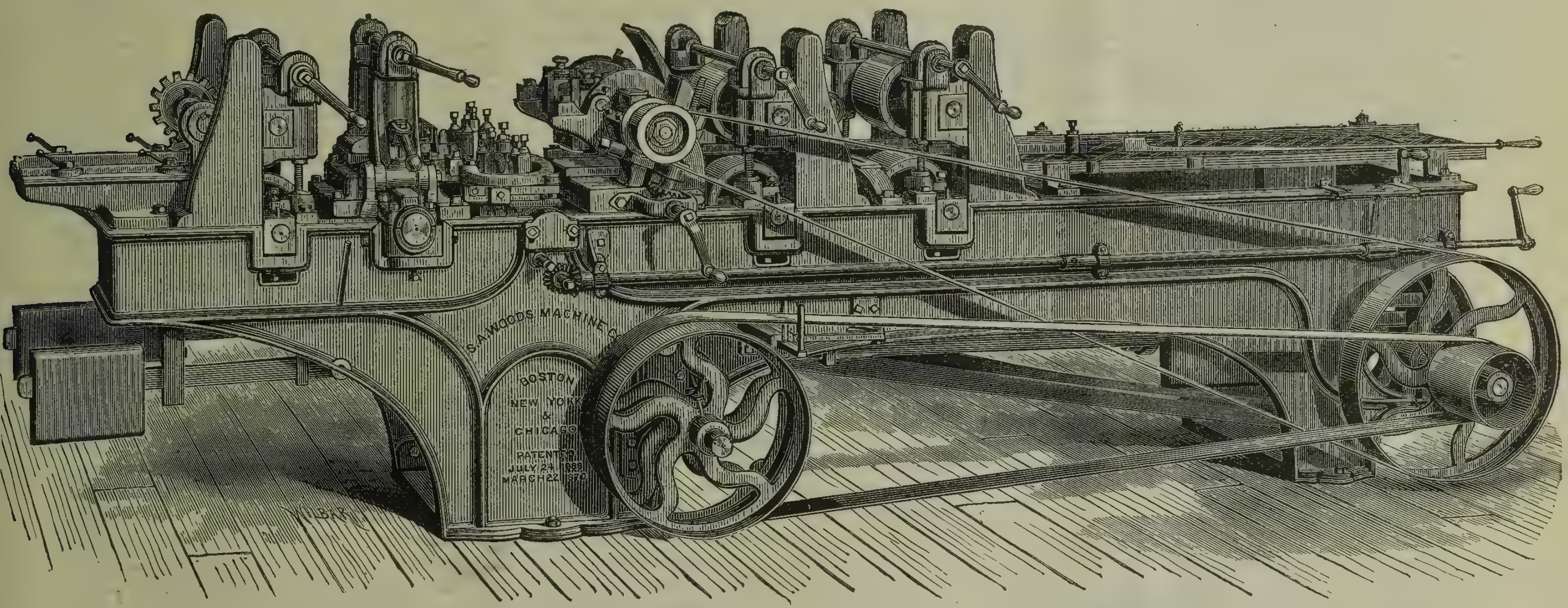
Vol. XIII.—No. 11. NOVEMBER, 1881. THIRTEENTH YEAR.

New Heavy Pattern Flooring Machine.

To our previous descriptions of selected examples of the improved wood-working machinery manufactured by the S. A. Woods Machine Co., of South Boston, Mass., we add in the following a description, with an excellent illustration, of their new style heavy-pattern flooring machine, one of which they show at work in their very handsome exhibit of wood-working machinery at the New England Manufacturers' and Mechanics' Institute Fair in Boston, where it has received much attention and praise from mill-men.

This machine has been recently designed by the makers with special reference to meeting the requirements of large mills. With this object in view, it has screws arranged for that purpose. The pressure bar on the leading-in side of the top head is attached to swinging arms, which admits of the pressure bar working close to and directly in front of the cutters, thus preventing the tearing and splintering of the lumber, and is so constructed that it can be set forward or backward to admit of molding or other cutting. The bar upon the opposite side can also be adjusted back and forth for the same purpose. The pressure bars are also adjustable for the purpose of admitting molding cutters to be used on the under cutter-head. The one on the leading-out side being weighted, adjusts itself to the required pressure, and both bars are easily removed for the purpose of sharpening and re-setting. The bed over the under cutter is easily removed by throwing with expansion links upon both ends of the shafts that an equal pressure is obtained upon both edges of the board, causing it to always hug the guide and feed through straight. The method of suspending and weighting the feed-rolls is entirely new, and free from the usual top hamper and expansion gearing upon the work-side, which is customary in machines of this class, and which is a troublesome obstacle to the operator. The feed works are so arranged that a feed of from 25 to 100 feet per minute can be obtained.

The machine shown in our illustration is that designated as No. 2½ in the descriptive catalogue of the makers. It has a frame 12 feet long, six feed-rolls 8½ inches in diameter, weighs 6,500 pounds, and works 8 inches wide and 4 inches thick. A machine is also



NEW HEAVY-PATTERN FLOORING MACHINE OF THE S. A. WOODS MACHINE CO.

been modeled and constructed from an entirely new set of patterns, embodying many novel features, with extra large bearings, and every part proportioned with especial reference to convenience and durability in service, while possessing the important requisite characteristics of high speed and fast feed. With respect both to quantity and quality of its work, the makers claim this machine to be unequaled.

Both top and bottom cutter heads are made of solid wrought iron, slotted and lipped on all four sides, thus admitting of molding, rabbetting or beading cutters. Cast steel shafts of the best material extend entirely through the heads. The journals are large, and fitted with great care. The boxes on the top cutter-head are joined together by means of a yoke extending across and under the bed of the machine, instead of over the top, as is customary in machines of this class where the boxes are connected at all. This plan of connecting the cutter-head boxes is referred to by the makers as being specially advantageous, as it keeps the journals or boxes always in line, at the same time giving free access to set, re-set and sharpen the cutters. The under cutter-head is also mounted in a frame, and can be adjusted up and down by means of up the handle which loosens the binding-bolt, leaving the bed free to be swung up on the opposite end; then, by removing the pressure bars, the cutters can be readily got at. The head can be turned to present the various sides to the operator by means of the lever handle, which can be inserted in the holes in the collar seen at the end of the box, thereby avoiding the troublesome method of turning the head by the belts. The side spindle frames are attached to and move upon a round bar running across the machine, which enables the operator always to adjust and keep the spindles firm in their places, which is very important. The heads are of cast steel, and are provided with a patent hinged chip-breaker, which has proved so indispensable for rapid and first-class work. One of the side heads can be adjusted at the work-end of the machine, a scale being there fixed to show the width required.

This machine is provided with six feed-rolls, 8½ inches in diameter, one pair being placed at the end of the frame beyond the under cutters, therefore carrying the lumber entirely through, besides helping to keep the boards in a straight line past the side heads and under the cutters. These rolls are all heavily weighted, and are provided with expansion gears, and are so mounted made on the same frame to work 14 inches wide and 4 inches thick.

Full details of proportions of belts and other portions of driving mechanism are given in a descriptive circular of the makers, to which we refer for the same. The works of the S. A. Woods Machine Co. are located at South Boston, Mass., and the company have offices at 172 High street, Boston; 91 Liberty street, New York; and 61 South Canal street, Chicago.

Tunneling Mont Blanc.

The project of tunneling Mont Blanc bids fair to assume a tangible shape, it being pronounced by some of the most eminent French engineers a more practicable undertaking than that of the Simplon route. The estimates of cost for executing such a work, are, in the case of the Simplon, $27,000,000, and in that of Mont Blanc some $12,000,000 less. It is furthermore claimed that the Mont Blanc tunnel will make the journey from Paris to Genoa some 97 kilometers shorter, and from Paris to Milan 44 kilometers shorter than by the Simplon route. The most favored line of the projected tunnel, thus far, is from Chamounix to Courmayeur.

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 11. THIRTEENTH YEAR.

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Illustrated articles are indicated by an asterisk (*).

Renewal of Subscriptions.

A large number of subscriptions to the MANUFACTURER AND BUILDER expire with the December number, and we would request that subscribers send in their renewals promptly, so as to avoid any delay attendant upon receiving the ensuing numbers.

Another "Demonstration" by Keely.

The principle of the "persistence of force" has never been better illustrated than in the history of the remarkable person who has figured more or less prominently before the world for the past ten years as the discoverer of a new motive power. Mr. Keely to-day is apparently as far from giving the outside world a demonstration of the reality of his alleged discovery, by even the simplest practical exhibition of its utility, as when ten years ago he first essayed the *role* of a discoverer; but to his credit it must be acknowledged that, whether by reason of certain remarkable qualities of his own, or by the keenness of his managers, he has succeeded in keeping the thing going all this time in spite of repeated failures and broken pledges.

As time passes on, the mystery surrounding the alleged new form of energy becomes progressively denser. At first, the world was informed that Mr. Keely had discovered a method of evolving from air and water a cold vapor of enormous tension. This explanation has at length given place to another, which, if it had been specially devised for the purpose of mystification, could not have been surpassed in ingenuity. A new vocabulary has been constructed to designate the phenomena, qualities and conditions of the mysterious power—a vocabulary that rivals in lucidity and ponderosity the jargon of the alchemist and astrologer. The cold vapor has given place to vibratory impulses of immeasurable energy brought into activity by disturbances of atomic equilibrium. There is something overpowering in the illimitable possibilities conveyed in Mr. Keely's clear and satisfactory statement of his views upon atomic vibration, as recorded in the *verbatim* report of a stenographer of one of our enterprising dailies.

"Vibration is a difficult thing to define if we speak of it theoretically," began Mr. Keely. "Yet it has been a subject of deep study for the last thirty years. The scientific men of the world cannot explain it; they do not understand it, and it remains a mystery in the world to-day. If I were to assert that I could make a machine which, by a certain process, I could create a disturbance of equilibrium so as to produce a pressure of 100 tons to the square inch, many persons would be dumbfounded; and yet such is the case with the machine before you. The water used in the machine does not furnish the power at all. It only furnishes the means for the multiplication of the energy primarily induced by the disturbance of the equilibrium. The process involved in etheric liberation is the same as is familiarly witnessed in the liberation of gases from water, water being known as of the highest specific gravity and hydrogen gas as of the lowest. The liberation of the ether in my machine furnishes simply the medium, and that is used as introductory of the disturbance of the equilibrium, which gives the initiatory impulse. It is well known that by means of a mechanical impulse innumerable vibrations can be produced per second, and these vibrations, I claim, can be produced by what I call the theory of interatomic ether acting upon molecular construction. One of the most curious facts in connection with my machine, is that it produces a substance which permeates everything—it permeates metals. If you were to break up the laws of cohesion, you would liberate this substance and develop or release millions of tons of power. The same rule applies to air and water. They contain millions of tons of latent power. There is enough latent power in the air of this room to run a 1,000 horse-power engine for ten years. In my machine the force is in the vacuum, because the power which is to be liberated is greater than the power behind it. In my machine I have two forces at work—the negative vibration and the positive vibration. Negative vibration is vibration that attracts, and positive vibration is that which propels. I could not operate my engine if it were not for both of these agencies. The relative strength of the negative force is 33⅓ per cent, and the positive is 66⅔ per cent."

There are about two solid columns more of this kind of talk, which it is unnecessary to inflict upon our readers. The foregoing quotation is given as a sample brick, to show our readers that Mr. Keely has evidently got things down very fine.

Mr. Keely has been about ten years in elaborating his theories—if the mystifying jargon quoted in the preceding paragraph is worthy of being dignified with the name—and it will be of interest to inquire, What has he succeeded in doing in the way of practically utilizing the immeasurable floods of energy he talks of so glibly? From all that has been reported of the late "demonstration" given to a select few who were invited to attend an exhibition at his workshop in Philadelphia, Mr. Keely, with his preposterous complication of cylinders, generators, conneeting tubes, globes, plungers, valves, and other mechanical paraphernalia, succeeded in turning a wheel, firing a bullet through a three-inch plank, raising and supporting a lever alleged to represent a resistance of 32,000 pounds to the square inch, and in doing several other simple things that could very readily have been accomplished by any skillful mechanic with very ordinary appliances and without any pretence of mystery. The same kind of a demonstration we remember to have witnessed in Mr. Keely's workshop several years ago; and from all appearances he has progressed no further towards the utilization of his alleged discovery than at that time.

This sort of nonsense is getting to be monotonous. Gullible newspaper men, and credulous stockholders who could not tell a piston-rod from a monkey wrench if their lives depended on it, may be impressed with Mr. Keely's "demonstration," and overawed by the incomprehensible bosh of his "explanations," but until he fulfills the least of his numberless broken promises and puts his preposterous motor down to some honest work in some one of the thousands of factories and workshops that abound in our neighbor city—something that any one can see and understand, instead of juggling with levers and firing bullets behind barred doors, the world at large will set him down as a clever trickster, and his alleged motor as a fraud.

As an evidence that the "demonstration" above referred to was by no means so conclusive as some of the "newspaper scientists," who were present as witnesses, gave their readers to understand, we may allude to certain facts—which have come to pass since the foregoing was written, and which place the alleged "demonstration" in anything but a successful light. The facts in question, are that the stockholders have since held a meeting, *not* to express their complete satisfaction with the "demonstration," and unbounded confidence in Mr. Keely, as might have been supposed, but to express their dissatisfaction in the form of a resolution to the effect that "if Mr. Keely did not patent something within ten days, he would be proceeded against legally." This statement, should it be verified, may perhaps warrant the interpretation that these patient and long-suffering gentlemen, heart-sick with hope deferred, may at length have awakened to the frightful possibility that during all these years of weary waiting they have been sublimely humbugged.

The Dangers of Electric Lighting.

The recent occurrence of a disastrous mill fire in a neighboring city, in which the origin of the conflagration was attributed to the dropping of heated particles of the carbons from a naked electric arc light upon a pile of combustible cotton yarn upon the floor beneath it, has called forth quite an amount of discussion concerning the possible dangers to be apprehended from the general introduction of electric lighting.

As the use of the electric light is as yet comparatively limited, we have still considerable to learn in this respect; but we feel quite safe in affirming that the elements of danger, both to person and property, attending its use, can easily be predicted and simply provided against. As is invariably the case, many exaggerated statements are indulged in by those, who, from interested motives, oppose the innovation; but

there can be no doubt that there are certain peculiar and serious dangers to be apprehended and guarded against in connection with the electric light.

In the production of this light, the electric currents employed are very intense, and for their conveyance large conducting wires of copper are used. So long as the continuity of these conductors is not destroyed, or the charge they are called on to carry is not so great as to exceed the carrying capacity of the conductors, there is no danger; but when, from whatever cause, some obstruction, or unusual resistance, to the passage of the current is interposed, or the wires become surcharged, or come into contact with telephone or telegraph wires, all of which accidents are liable to occur, at once the electric light becomes a source of serious danger both to life and property.

While on the one hand it is right and proper to denounce the extravagancies of those who grossly exaggerate the dangers of the electric light, it is no less the duty of the technical press to fairly state the real dangers to be apprehended from its general use, and to warn the companies engaged in its introduction, to take every needful and proper precaution to guard against them. If these precautions are taken in time, much needless trouble will be avoided; if they are not taken, they themselves will be responsible for the creation of serious alarms and a prejudice against electric lighting that may be a hindrance to its introduction for years to come.

The National Association of Fire Engineers at their last meeting, held in Richmond, Va., considered this subject very fully. In their discussion of the subject, a number of cases of fires and injuries to persons, due to the electric lighting systems now coming into general use, was mentioned, and a special committee was appointed to consider the question.

We may have occasion in a future number to refer more at length to the results of this discussion. We have only to add here that it behooves the companies engaged in the business of introducing the electric light, to recognize the dangers involved in the use of their systems, and make adequate provision to guard against them. The means for regulating the strength of the current employed, should be under complete control to prevent the surcharging of the wires; the latter should be of ample dimensions, and should be carefully insulated; they should be carried underground in conduits separate from those used for telephone and telegraph lines. This precaution would obviate the very common danger of the crossing of such wires with the electric light wires, which is incurred with the present overhead lines. Within buildings the electric light wires should be so prominently colored, or otherwise marked, that they could be instantly distinguished at sight by any one; and "cut-outs" should be provided at the point of entrance to each building, so that the current may be shut off when required.

Progress of Cremation.

The process of cremation is not making as rapid an advance, either in Europe or in this country, as its friends and advocates had hoped for it, from the enthusiasm with which it was taken up on the revival of the idea in Italy in 1873 and 1874, when it formed one of the principal topics of discussion before the learned societies and congresses of savants on the other side of the Atlantic.

Nevertheless, the friends of this very rational reform have no cause for discouragement, as the facts of the case show that at the present time the practice has obtained a secure foothold in Italy, Switzerland and Germany, where it has been recognized by the authorities as a legitimate mode of disposing of the dead. In some of the continental cities, notably in Milan, Dresden and Gotha, imposing edifices have been erected, in which the incineration of the dead is conducted with all the solemnity and circumstance that the most ardent conservative would desire. The International Hygiene Congress which met in Milan in 1880, took special and favorable action respecting the institution, and among other things appointed a special international committee to draft and present to the several governments, within a year, a series of propositions for expediting the adoption of cremation.

In England several attempts have been made to introduce cremation, but hitherto without success, because of the opposition of the ecclesiastic authorities. The most recent effort of this kind, however, promises to be attended with more success, the society in question having been assured by the government that the execution of its purposes will not be interferred with by the law. It is said, however, that the society, not satisfied with this form of official toleration, is seeking, before going into active operations, to secure the express sanction of the government. In this country, thus far, no organized effort has been made to introduce cremation. The Le Moyne cremation furnace at Washington, Pa., is still in existence, and is occasionally used, though the number of bodies cremated in it since its erection will probably not exceed a dozen.

The German Underground Telegraphic System.

Recent cable dispatches convey the intelligence that the extensive system of underground telegraphs for some years in process of construction in Germany, has been finally completed. All the chief cities and towns of the German empire are now connected by underground wires, constituting an extensive network of land lines, and the poles and overhead wires have been banished.

Nearly all of the countries of Europe have long since discarded the use of the aerial system of line construction in the streets of their cities and towns, but Germany deserves the credit of being the first to lead the way in the adoption of the underground system in the construction of extensive land lines and in the total abandonment of the overhead system throughout her territory.

As we have hitherto strongly advocated the adoption of the underground system in this country, we record the consummation of this great work with especial pleasure as an additional proof of the fact that we have long since recognized, and endeavored to impress on others, that the underground system is destined to be the only system in use in the future, and that its adoption in this country is simply a question of time, which the persistent agitation of the subject may hasten. We give below, for the information of our readers, a brief history of the plans and execution of the German underground lines.

The cable of these underground lines consists of seven or more copper wires, separately insulated by a gutta-percha covering; these, laid together, have a double sheath of gutta-percha with an intermediate compact layer of tarred hemp yarn, again surrounded by a close covering of iron wire, in turn protected by another layer of tarred hemp, the whole being covered, when laid, by a thick coating of coal tar free from creosote. The wire used is made in England, Felton & Guilleaume making the cable in their great factory at Mulheim on the Rhine. Siemens & Halske sheath the cable in their factory at Berlin. The Siemens cable, in addition to following the terms of the contract, is surrounded by a composition of asphalt. The cables are laid in trenches three feet deep, following the course of the great highways, not under the road, but at one side, along the footpaths. In towns where it is necessary to go under paved streets, they are laid near the line of the gutters, about two feet from the curbstone. The work was so methodically planned as to proceed with great rapidity. The workmen were divided into three detachments, the first being preceded by a few men who marked two parallel lines for the sides of the trench. These were immediately followed by the gang, who had been previously instructed as to the depth of the trench A short distance behind the second division of workmen began laying the cable, covering lightly to the depth of two or three inches as they went with sand or earth free from stones. This was done to prevent any injury to the cable by the heat of the sun. Carefully, as short distances were completed and as fresh cables were connected, the connection was tested with the field telegraph apparatus, which was carried with the force, and not until assured of perfect success was the final covering of coal tar laid over the cable and the trench permanently filled up. In crossing streams, when bridges were at hand, the cable was let into the stonework of the bridge; where this was not possible, a cable prepared for the purpose was laid in the water by means of boats or small steamers. Here the force of the stream, the depth of the winter ice, and the character of the vessels navigating it had to be considered.

There is no difficulty in determining the location of breaks is such buried lines, by suitable electrical instruments, which work with such perfection as to enable the exact spot of the break to be reported, and repairs are completed in a few hours. Last autumn, upon one occasion the electric connection between Berlin and Cologne was suddenly interrupted. By means of this instrument, one of which is kept at each office, the locality of the break was discovered, and a telegraphic order to examine the particular spot sent to the office nearest that point. The workmen upon arrival found a country fair in progress and the ground covered with booths erected for the sale of wares. In erecting one of these booths, an iron stave had been driven into the earth, striking the cable, most effectually breaking connection.

The first underground wire was laid in 1876, between Berlin and Halle, a distance of 105 miles. It proved such a complete success that preparations were at once made for a wide extension of the system. Now that the work is completed, the empire is crossed by two great main cables, stretching from Königsberg in the north to Strasburg in the south, and from Hamburg in the northwest to Ratisbon in the southeast, intersecting at Berlin. Strasburg has also been connected with Metz. In addition, another wire curves up from Strasburg through Cologne to Hamburg, while Ratisbon and Königsberg are connected. A wire also binds together Berlin, Dresden, Stuttgart and Munich, communicating with a main cable passing through South Germany. Branch lines also extend to Kiel and Cuxhaven, to Bremen and Emden, thus joining the North Sea cable communicating with England and America. The scheme was for the most part planned by Dr. Stephan, Postmaster-General. The total cost has been about $30,000,000, and the total length of the completed lines is about 3,500 miles.

Rapid Transit in New York.

But few persons who have not been in New York since the construction of the elevated roads, and witnessed their equipments and operations, can have any adequate idea of the extent of them, and of the people, machinery and appurtenances required in working them. A recent inventory discloses the fact that there are 32 miles of roadway, 161 stations, 203 engines, and 612 cars, while 3,480 trains a day are run. There are 3,274 men employed on these roads, 309 of whom are engineers, 258 ticket agents, 231 conductors, 308 firemen, 395 guards or brakemen, 347 gatemen, 4 road inspectors, 106 porters, 33 carpenters, 27 painters, 69 car inspectors, 140 car cleaners, 40 lampmen, and 470 blacksmiths, boiler-makers and other mechanics employed on the structure and in the shops. Most of the ticket agents are telegraph operators, but there are 13 other operators employed. There are four double track lines in operation. The aggregate daily receipts vary from $14,000 to $18,000; and as many as 274,023 passengers have been carried in one day. Engineers are paid from $3 to $3.50 per day; ticket agents, $1.75 to $2.25; conductors, $1.90 to $2.50; firemen, $1.90 to $2; guards, or brakemen, $1.50 to $1.65; and gatemen, $1.20 to $1.50. The above items do not include machinists and other employees in the workshops, or the general officers, clerks, etc.

The Atlanta Exposition.

The great Cotton Exhibition at Atlanta, for which such elaborate preparations were made, was formally opened on the 5th of October, and at the time of this writing is in full operation. In many respects, it must properly be regarded as the most important exhibition ever held in the United States, for its direct effects in fostering and stimulating the growth of manufactures in the South will be of enormous importance to that section, and indirectly to the country at large. By all who are capable of judging, it is unanimously acknowledged that the Atlanta exhibition is destined to make the beginning of a new era in the industrial department of the Southern States. These facts lend especial interest to the event, and warrant us in placing on record the more important circumstances relating to the conception and development of a project that has resulted so successfully.

The Atlanta Exhibition originated in a suggestion made by Mr. Edward Atkinson, of Boston, a political economist and statistician of considerable note, who, by reason of his services in connection with the textile industries represented at the Centennial Exhibition at Philadelphia, was chosen by General Walker to compile the textile statistics for the census of 1880. In connection with the duties thus imposed upon him, the suggestion of an exhibition devoted to the cotton industries was made in some correspondence with several prominent citizens of the South. This correspondence found its way into the New York *Herald*, with comments warmly endorsing the proposal. The subject was thus brought to the attention of Mr. H. I. Kimball, of Atlanta, Ga., now the Director-General of the exhibition, who, keenly appreciating the possible advantages of such a project in advancing the interests of the city of Atlanta and of the South, extended an invitation to Mr. Atkinson to visit Atlanta and place the subject properly before the people of that city. The result of that visit was the organization of the project of a cotton fair and the selection of Atlanta for that purpose in the autumn of 1881. Once formally projected, the progress of the scheme thereafter was rapid and satisfactory.

A large sum of money was at once subscribed by the citizens of Atlanta, and Mr. Kimball, as the representative of the project, visited the North, and succeeded without difficulty in enlisting the warm interest and material assistance of nearly every leading city of the North and East. The newspapers were especially friendly to the enterprise, and advocated it in the most cordial manner.

The success of these preliminary operations was so complete and encouraging that the managers were induced to take into serious consideration certain suggestions that had been made, to extend the scope of the proposed exhibition so as to make it include all the textile industries, and to let it afford the opportunity at the same time of giving a general exhibition of the natural—agricultural and mineral—resources of the South. These suggestions were finally adopted, and out of them grew the present extensive and admirable exhibition at Atlanta, which promises to give a vigorous impulse to the industrial development of the Southern section of the Union.

The exhibition was formally opened on the 5th of October with great enthusiasm, by the Governor of the State of Georgia, in the presence of a great throng assembled to witness the ceremonies, which are said to have been very imposing and attractive. The magnitude of the buildings, the extent and variety of the exhibits, and the tasteful arrangement of the grounds, have been the general theme of comment and praise by the representatives of the press in attendance.

The exhibition is held in Ogelthorpe Park, in the suburbs of the city. The buildings cover over 20 acres of ground, and are built in first-class style. The main exhibition building, in the form of a cross, with a square central pavilion with towers, is placed in the center of a half-mile race course, filling it entirely. The more important buildings besides the main building, are the Art and Industrial Pavilion, 560 feet in length; the Judges' Hall, 300 by 100 feet; the Horticultural Hall, 100 by 90 feet; and a large building devoted to the display of the minerals and woods indigenous to the South.

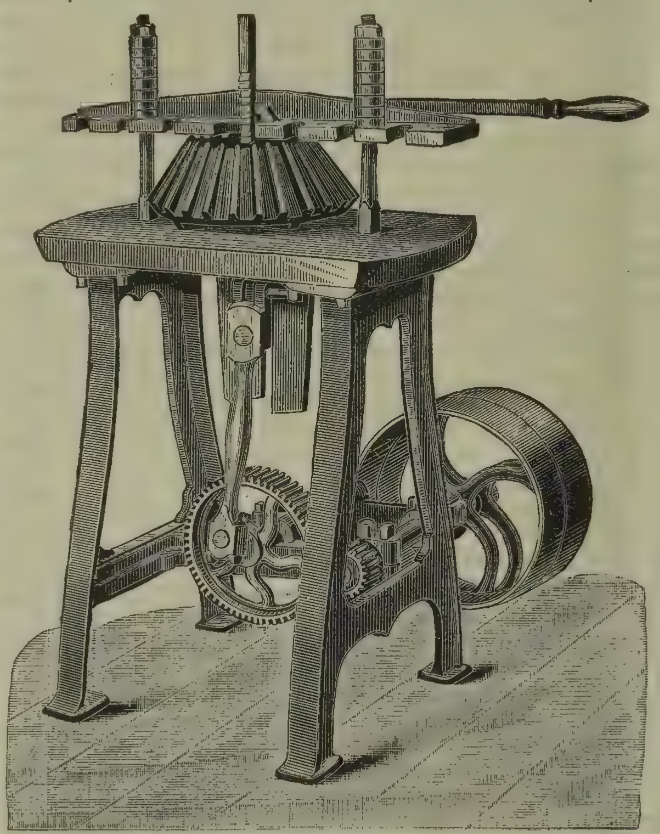
Over 1,800 distinct entries had been made before the period of opening the exhibition, among which are a number of English exhibits of cotton machinery, which are in operation side by side in competition with improved American machinery of the same class. Though the scope of the exhibition has been considerably extended, cotton and its manufactures maintains its supremacy at the fair as the leading Southern staple. Everything relating to its culture and manufacture is here displayed. It is seen in the seed and in all the stages of its growth; it is displayed in every stage of manufacture, from the coarsest yarn to the most finished fabrics into which it is capable of being manufactured.

The display of machinery, which is very extensive, is chiefly confined to the main building. The motive power is supplied by three large steam engines, which are entered for competition. Besides the machinery for cotton, wool, hemp and silk, the building contains numerous costly exhibits of manufactured goods from leading Northern and Eastern manufacturers. The Industrial Hall, the next largest building, contains a rich and varied display of the more artistic products of American and European manufacturers. The display of woods and minerals in the Mineral Annex is one of the most interesting features of the exhibition. In every respect, up to the present time, the Atlanta exhibition has been an unqualified success, which reflects the greatest credit upon its managers, and which must lead to most important results.

We mention in conclusion a number of the more prominent textile exhibits: The Willimantic Thread Co., and the Clark and Coats companies, have very complete exhibits of their machinery, the process of making finished spool cotton from the raw material as it comes from the hands of the picker, being shown in full detail. The Kitson Machine Co., of Boston, show a large and handsome display of cotton-picking machinery; the Bridesburg Manufacturing Co., of Philadelphia, have entered a full line of their machinery; F. A. Leigh & Co., of Boston, have entered Howard & Bullough's spinning frames and other special machinery; cotton-gins are represented by no less than sixteen manufacturers; George Crompton, of Worcester, Mass., has a fine exhibit of Crompton looms at work on fancy goods; H. B. Claflin & Co., of New York, have a very extensive and varied display of hand and machine made foreign fabrics, and over forty cotton mills are represented by fine show-cases containing their fabrics. The thread manufacturers are represented by the Willimantic Co., George A. Clark & Bro., Thomas Russell & Co., J. & P. Coates, Auchincloss Bros., the Conant Thread Co., and others, nearly all of whom show machinery in operation. The Women's Silk Culture Association is represented by a fine display of American grown cocoons and reeled silk, and by a fine collection of the products of the Philadelphia silk mills.

The exhibition will remain open until December 31, 1881.

Improved Key-Seat Cutting Machine.



HEAVY KEY-SEAT CUTTING MACHINE.

The accompanying engraving gives a representation of an improved heavy key-seat cutting machine for cutting seats into pulleys, gears, wheels, etc., manufactured by W. P. Davis, of North Bloomfield, Ontario country N. Y. A special advantage claimed for this machine is the feature that the cutter, which is strongly supported above and below the work to be cut, and arranged to be adjusted to give any desired draft to the key-seat, is moved to give feed instead of the piece being operated on.

The machine will admit of any sized wheels, and cutters of any size may be used and changed at a moment's notice when necessary. It is made entirely of iron, and is therefore substantial and not liable to get out of working order. It will be found specially serviceable to manufacturers of threshing, reaping and mowing machinery, as well as for other branches of machine work where a large amount of key-seat cutting in gears, pulleys, etc., is required.

The maker builds two sizes of this machine, one adapted for heavy mill work (though it will cut small seats as well), and the other specially designed for the wants of builders of agricultural machinery; and the claim is made that "there is no machine now in use for the purpose that will compare with it, either for rapidity of work, cheapness or durability."

Exportation of Pearl Shells.

The exportation of pearl shells is likely to receive a stimulus through a recent shipment of a sample lot of thirty-six bushels from Baltimore to a manufacturing establishment in Paris. The pearl shells are collected on the Southern shore of California, and carried on fruit boats to Santa Barbara, whence agents stationed at that point ship them to Eastern consignees. They vary greatly in value, and many of those gathered are subsequently rejected as worthless, owing to their having become sunburnt or brittle from exposure. In the center of each shell is an excrescence differing in hue from the remaining surface, which has a special value, and is separately preserved for ornamental purposes while the rest of the shell is cut up for buttons.

PAPER BLANKETS.—Paper being a good non-conduc of heat, has long been recommended for blankets, but it has been left to a Manchester (England) firm to carry out the idea. This firm has succeeded in making a paper blanket which is as warm and as pliable as wool, and costs, in comparison, but a trifle.

The Boston Fairs.

It would be unjust to attempt to make a comparison between the two fairs in progress at Boston, viewing one from the standpoint of the other, because each is so different and unique in the special direction of usefulness in which it has developed. The fair of the New England Manufacturers' and Mechanics' Institute having at its back the support of a number of the largest and most prominent manufacturers of the East, is notable for its extensive and magnificent display of machinery employed in the boot and shoe, textile, and iron and wood working and allied industries. The Charitable Mechanic Association, on the other hand, is characterized by the rich displays of the products of these industries, of ceramics, and of art. We are now speaking of the distinctive characteristics of the fairs, and do not wish to be misinterpreted as asserting that either fair is devoid of the general features possessed by the other. This would be unfair, as the New England exhibition has a very creditable display of manufactured products and of art, while that of the Charitable Association has a very good representation of miscellaneous machinery. A visit to the fairs since our last issue found all arrangements and exhibits complete, and both meeting with substantial success, attested by the large crowds present daily.

Viewing first the New England fair, we examined with interest many fine exhibits that in our previous issues we have only referred to briefly. One of the best, and at the same time most noticeable features of this fair, is the classification of exhibits. The advantage of such a system in exhibits is readily seen. For instance, an operative of a shoe factory is specially interested in new shoe machinery. At this fair he finds it all in one department; machines of the same kind, but of different makes, are together, and he may hurry past exhibits of less interest without fear of missing any particular machine for which he may be looking. So in the case of an iron worker who has limited time in which to examine products and machinery of his trade. Here it is quickly found, and no time wasted in hunting about the halls. The chief center of interest at this fair continues to be the "Model Shoe Factory" exhibited by Houghton, Coolidge & Co., and well it should be, as it is the only exhibit of the kind that has ever been shown at any exhibition in the world. One hundred and thirty workmen are employed, running 80 machines, and producing 1,200 pairs of top boots and low-cut shoes daily. An Exeter engine, manufactured by the Exeter Machine Works, of Exeter, N. H., supplies the power for running the shoe factory, and attracts universal admiration from visitors. It is the only engine at the fair that has to do steady work, and its daily performance entitles it to the highest praise. We shall publish an illustrated description of it in our December number. The Exeter Works also have one of their admirable blowers on exhibition. Their manufactures in this line are very extensive, comprising blowers and exhausters for foundries, ventilation, removal of emery dust, sawdust, shavings, etc. The exhibits of textile machinery in operation at this fair are next in interest to the boot and shoe machinery, and also surpass any former display made in this branch of industry. It is creditable to the promoters of this fair that they succeeded in so heartily enlisting the interest of mill men in this enterprise, and thus conferring upon the public a substantial benefit, which it has repaid by the undisguised interest it has taken in the wonderful machines that move almost as if by magic, tranferring the warp and woof into textiles of various kinds. The Hancock Inspirator Co., of Boston, have three of their inspirators at work feeding the boilers of Kendall & Roberts, Hill, Clarke & Co., and Hawkins Main Co. The New England Gauge Co., of Boston, show their automatic cylinder lubricator on the engines displayed by the Swamscot Machine Co., of South New Market, N. H., and it has given the most gratifying results, the exhibitors of the engines, Geo. K. Paul & Co., of Boston, being highly pleased with their performance; and Mr. Phillips, Superintendent of the Gauge Company, informs us that he has received a number of orders through their exhibit from Messrs. Paul & Company. The exhibit of the S. A. Woods Machine Co., of Boston and this city, attracts considerable attention by reason of the very complete display of wood-working machinery which they show. This embraces their planing and matching machines, new heavy-pattern flooring machine (illustrated on our first page), improved jointing machine, improved door planer, improved adjustable saw table, double surface planer for shop work, endless-bed planer, panel planer, and several other of their machines. This is the largest exhibit of wood-working machinery at the fair, and has elicited universal admiration. The display of B. F. Sturtevant does credit to that enterprising manufacturer. Mr. Sturtevant never does anything half-way, and he certainly has succeeded in bringing together at this exhibition, and at the fair of the Charitable Association, a huge and magnificent display of blowers and exhaust fans of his manufacture. Seldom if ever has the opportunity been offered to witness the collection of one manufacturer on so vast a scale. The Walworth M'f'g Co., of Boston, Mass, make a large showing of steam radiators with an ornamental display of brass tubing, in which guage cocks, oil cups, valves, steam guages, steam whistles and a great variety of other fittings, are very tastefully worked in. Prominent in this exhibition is the Handren & Ripley pressure regulating valve. Chas. F. Curwen, proprietor of the Salem Foundry & Machine Shop, of Salem, Mass., exhibits his cop-winding machine, tan press for pressing spent tan bark, and the Curwen grate bar for steam boilers. Mr. Curwen has also a similar exhibit at the fair of the Charitable Association. The Hartford Engineering Co., of Hartford, Conn., exhibit a high-speed automatic cut off engine, shown by their agents, Hill, Clarke & Co., of Boston. The engine is 14 by 24, and runs at 130 revolutions. It is employed in running the textile machinery. The Medart pulley made by the Hartford Engineering Co., is also shown. The Prescott Manufacturing Co., of Boston, exhibit their sliding door hangers, embracing their truss hangers for warehouses, factories, freight stations, sheds etc.; brace hangers concealed from view for parlor doors and finished work, and car hangers for box freight cars, etc. This company have a fine exhibit at the Charitable fair also. C. D. Wainwright, of Boston, exhibits Strong's feed-water heater and filter, for purifying feed water for boilers. This very excellent device was fully illustrated, and described in our September number, and has received since it has been on exhibition, the encomiums of all steam users who have witnessed its operation in connection with the Kendall & Roberts boiler to which it is applied. The New England Press Brick Co., of Boston, exhibit Gregg's patent steam and hand brick presses, for making the finest grades of front, ornamental and fire brick, artificial fuel, and building blocks. The company exhibit a fine line of the latter products, all of which are of great beauty and show the admirable results of which their machines are capable. This company also have an exhibit similar to the one at the fair at the Charitable fair. The products of the H. W. Johns Mfg. Co., of this city, are exhibited by their Boston agent, Chas. W. Trainer & Co. This display embraces asbestos paints of various kinds, asbestos boiler and pipe coverings, asbestos steam packing, and asbestos boards, paper and cloth. The Pulsometer Steam Pump Co., of this city through their agent S. B. Everett of Boston, exhibits the new Pulsometer in two sizes, both of which are in operation. Two of these pumps are also exhibited at the Charitable fair.

Passing now to the fair of the Charitable Mechanic Association, we find many handsome exhibits that deserve more than passing mention. As we have already observed, this fair is particularly rich in pleasing fancy exhibits of manufactures and of art treasures. The magnitude of the exhibit of paintings and engravings, affords a rare opportunity to lovers of art. One of the most valuable displays in this fair is that made by the Boston Society of Architects, showing a full line of building materials under the heads of construction and ornamentation. The latest improvements, usually known only in building circles, are exhibited in such ways as to demonstrate at first sight their practical advantages. The exhibits in this department are gathered in groups which include building materials, tools and machines of construction, systems of fire-proofing, structural devices, hardware, sanitary appliances, heating apparatus, ventilators, elevators and dumb waiters, pumps and windmills, speaking-tubes, fire-escapes, chandeliers, gas and electric lighting machines, and the various methods of interior finishing. The steam power for the fair is furnished by three boilers of Benzon steel, manufactured by the Whittier Machine Co., of Boston. They are 6 feet in diameter by 16 feet long, and have 140 tubes 3 inches in diameter. The shell extends 13 inches from the fronts, and the iron flue is partly projected over the fronts of the boilers. This company have also two passenger elevators in operation from the lower to the upper floors. They are run at a speed of 160 feet per minute, and are driven by Whittier hoisting engines. They are fully equipped with safety appliances and other necessary arrangements. The same company exhibit also the Ericsson pumping engine manufactured by C. H. Delamater & Co., of this city. The Curtis Rugulator Company, of Boston, display the Curtis pressure regulator for steam, water, and other fluids. This interesting device is illustrated on page 256 of the present issue. A. F. Upton of Boston, has the Jarvis furnaces burning cheap fuel, and the Sheffield grate bars applied to the Benzon boilers referred to above, and exhibits also a fine collection of Schutte & Goehring's jet instruments and their Korting injectors, the latter being employed to feed the boilers. He also shows Reed's sectional pipe covering for steam pipes, in practical use, the pipes of boilers and engines being covered with it. The Worthington duplex steam pump of H. R. Worthington, of this city, is exhibited in operation, by D. H. Johnson, Boston agent, and attracts considerable notice on account of its admirable performance. The Messinger Boiler Feeder Company, of Boston, exhibit the Messinger reliable boiler feeder, for stationary, locomotive and marine boilers. This injector possesses many features that render it of great value to the steam user. It is always reliable, and is not dependent upon the steam pressure to lift its supply of water at starting, and drafts from a depth of 25 feet with 10 pounds pressure of steam. It has an auxiliary attachment for drafting boiling hot water, and increasing the capacity of the machine at will. It utilizes hot water, avoiding a heated suction pipe, and does not waste water. It can be instantly started under all conditions, and will feed two boilers at the same time. This injector is used as an auxiliary feed to the Benzon boilers. The Valley Machine Co., of Easthampton, Mass., exhibit the Acme steam pump in six different sizes. These pumps are pump and engine combined if steam is the motive power, or they can be driven by belts if desired. They are particularly adapted for lifting water, feeding boilers, or for any purpose where it is required to move water. Arthur E. Rendle, of this city, exhibits his patent system of glazing without putty, the advantages of which have already been set forth in these columns. Austin, Obdyke & Co., of Philadelphia, exhibit through their Boston agents, S. D. Hicks & Son, Austin's expanding water conductor, or rain spout, which admits of expansion and contraction, and cannot therefore burst even when exposed to the extremes of climate. In closing the present article, we cannot but praise the very complete arrangements of this fair. Seldom has it been our privilege to find every want of the visitor so thoughtfully provided for. The members of the press are especially indebted to the managers of this fair, for the courtesies which have been extended them, both in the ample and convenient quarters which have been provided for their use, and the polite attention uniformly shown them.

Improved Hoisting Machinery.

We illustrate and describe in the following the improved hoisting machines manufactured by Messrs. Clem & Morse, of 413 Cherry street, Philadelphia, which, in their mechanical features, are claimed by their makers to combine the desirable qualities of simplicity, durability, safety and certainty in action, with ease and economy in working.

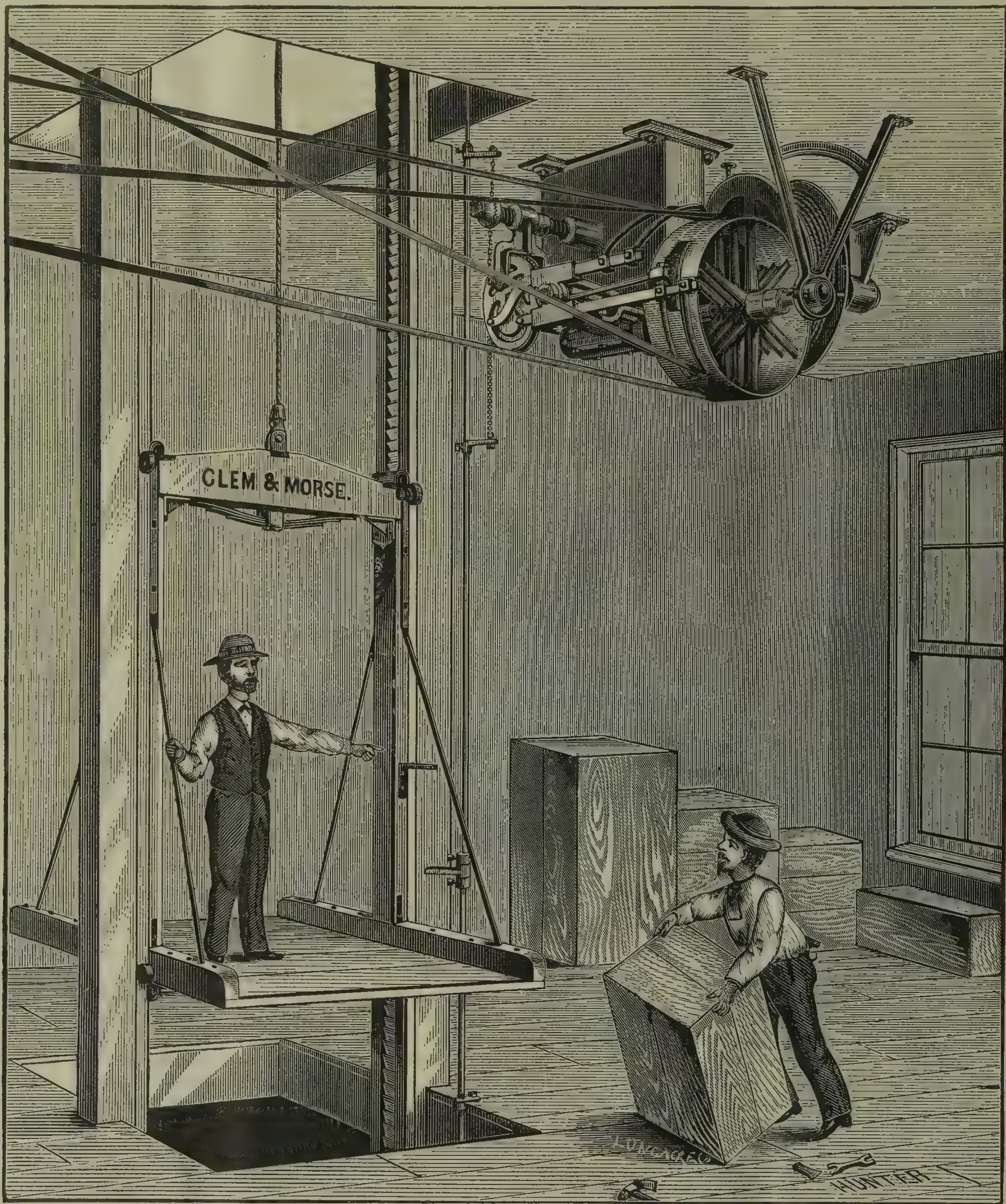


Fig. 1.—CLEM & MORSE'S STEAM-POWER HOISTING MACHINE.

Fig. 1 represents the steam-power hoisting machine of these makers, as applied for freight service, showing the hoisting mechanism in position. The mechanism of this apparatus has been made the subject of careful study by these makers, and embodies a number of important improvements, which add to its efficiency. The more important of these are the following: 1st. The belt shifter, which is a feature of the utmost importance in a power hoist. It is very simple in construction, and not liable to get out of order, as it has no rack, gearing or link motion, and is so arranged that while either of the belts are being shifted to the fast pulley, the other remains undisturbed. There is also an attachment which prevents the belts from shifting too far, and reversing the machine, as it will stop central, and leave the belts free from the fast pulley. 2d. The automatic stop, which can be set to stop the machine at any point, either hoisting or lowering, is so positive in action that it can be relied upon without depending on the stops generally used on the shifting rod or cable, though they are used also for additional safety. The automatic stop on the drum shaft renders it very desirable for outside hoisting, as the stops on the shifting rod are useless in that class of work, there being no platform to operate them. 3d. The brake, which is new in arrangement and very powerful, does not touch the pulley until it is brought into use, and it can be adjusted while the machine is in motion. 4th. The drum on which the cable winds is grooved, which prevents the cable from touching while winding, thus making it wear much longer. 5th. The driving worm, which runs at high speed, is made of the best steel, cut perfectly true in the lathe, and is enclosed in an oil-tight box or housing and run in oil. We would also remark at this point, that Messrs. Clem & Morse have just completed a machine by which they can cut worms and gears so that any number of teeth may be made to have a perfect bearing, instead of one and part of another, as is the case with the ordinary straight worm. 6th. To overcome the annoyance of serious trouble occasioned by loose pulleys when not properly oiled, the makers of these machines put a sleeve in the pulley, and use an oiler which curves around the hub of the pulley, so that the oil is thrown to the shaft by centripetal force. They also use self-oiling journals or bearings for the cable-carrier sheaves at the top of the building. 7th. The machine is fitted up in a mechanical and substantial manner. The platform or car is made of prime ash lumber, any size desired, and is bolted together and ironed in the strongest and neatest manner, suspended with fine wire cable, and has a well arranged safety attachment (which is invariably tested on all machines so constructed) to prevent it from falling in case the rope or cable should break. It also has roller guides, which save a great deal of friction. Some of these features will be more fully described in the account of the hand-

power machine which follows. These machines are made with a capacity of from one to three tons.

Fig. 2 represents the No. 4 hand-power elevator, with automatic hatch doors, made by the same builders, and which, while embracing all the approved features of standard machines of this class, is characterized by possessing a number of special improvements that enhance its value.

The machine is simple in construction, but particular attention has been paid to every detail that will add durability or ease in operating. The platform is made of selected ash lumber, and ironed so as to secure the greatest strength and neatness in appearance. The safety catches, which have proved their merit under most severe tests, are concealed in the cross-beam of the platform, and operated by the heavy steel coach spring shown underneath, so that in case of the cable breaking, they are shot out and caught by the toothed iron rack shown on the posts. On each side of this iron rack ash strips are placed, as a track for the roller guides, which are placed at four opposing points on the platform, to overcome all friction or binding when the platform is unevenly loaded. The platform is centrally suspended by a fine wire cable—which usage has demonstrated to be far superior to rope—and is counterbalanced with a weight adjustable to the load to be carried. The machinery is fitted up by skilled mechanics. The rope wheels are balanced, to make them run without shaking, and the boxes or bearings are bored out smooth in the lathe, and made self-oiling. It is provided with an improved brake, which is operated by a single check-line that does not require holding to keep the brake on or off, but remains stationary wherever placed by either an upward or downward movement of the hand of the operator.

In addition, the machine shown in our illustration (Fig. 2) is provided with a set of automatic hatch doors of simple construction, and very reliable in operation, which, while they are not an essential feature of the machine, are nevertheless a valuable addition in providing against the accident of persons falling through the hatchways, and are heartily endorsed by insurance companies as a valuable aid in checking the spread of fires. With this attachment, the doors are always closed except while the platform is passing through them. In ascending, a pair of curved iron rods, projecting above the cross-beam of the platform, raises the hatch doors, which, when relieved of support after the platform has passed through, fall and close of their own accord, but without any shock or jar, as the levers, engaging with rollers beneath the car, support them until they are clear down. In descending, a set of rollers on the bottom of the platform engage with a lever on each side, pivoted to the posts of the elevator and connected by a rod and link to the hatch doors, and as the levers are depressed by the descent of the platform, the doors are quickly raised and held in position until the platform has passed through, when, being unsupported, they close gently by following the shape of the bow on the cross-beam of the platform. These doors work equally well on the power machine shown in Fig. 1. Automatic doors do not work well when the guide posts stand diagonally in corners of the hatchway, but the same lever is used for automatic bars, which afford equal protection against stepping into a hatchway.

The makers call special attention to the Heebner patent governor, for which they own the sole right to apply to hoisting machinery; but which, like the automatic doors, is charged as an extra, and is never included unless so specified. Its method of construction is different from the governor on a steam engine, but the result attained is the same, as it instantly moderates any undue acceleration of speed when the platform is descending heavily loaded, and proves most valuable in connection with the automatic doors, by preventing the platform from obtaining such a momentum as to forcibly strike the levers, jerk the doors open, and throw them back violently against the posts, which is very apt to occur from the careless management of a machine unprovided with a governor.

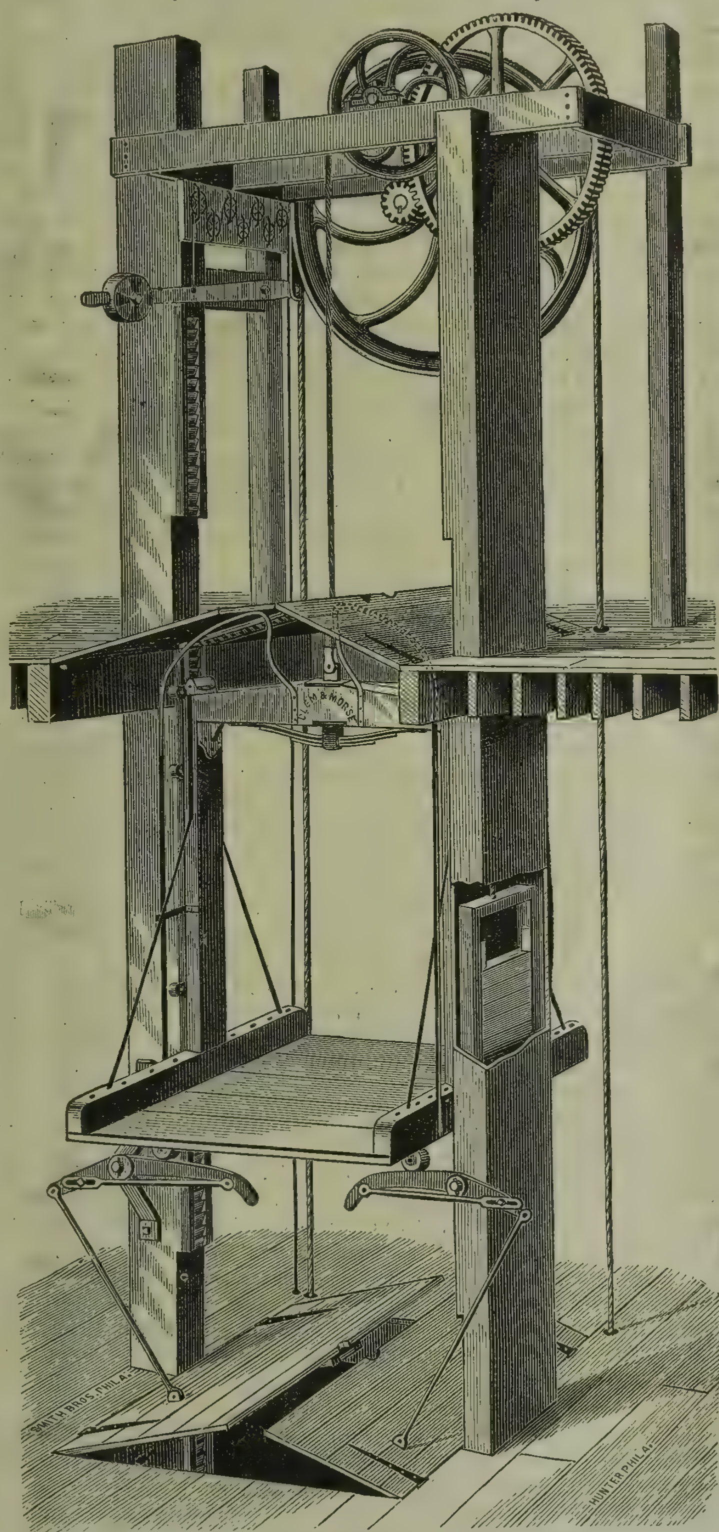


Fig. 2.—CLEM & MORSE'S HAND-POWER ELEVATOR.

The makers of these machines have been very successful in introducing them, and hundreds are now in use, not only in Philadelphia and its vicinity, but throughout the United States, and a number of shipments have been made to foreign countries during the past year. The firm of Clem & Morse, in addition to the foregoing, manufacture also hydraulic elevators for passenger and freight service, concerning which, as well as other details that may have been omitted from the preceding description, we refer to the address given above, or at their branch office, 108 Liberty street, this city.

Gold Beating.

The art of foliating, or beating gold into thin leaves to be used for gilding, was practiced by the ancient Hebrews and Egyptians, and therefore it cannot be claimed as one of the new discoveries of this fast age. A modern improvement, however, has been made, which replaces parchment with "gold-beaters' skin," which is prepared from the outer membrane of the large intestine of the ox. The intestine is partially rotted, in order to facilitate the removal of the membrane, which is cleaned, dried, beaten and pressed between paper, and also with alum, isinglass and the white of an egg, the result being a pure, clean and tough membrane, which will bear but slight injury after a continuous beating for several months with a 12-pound hammer.

To produce light and dark shades of gold leaf, the metal is alloyed with silver and copper. The addition of the baser metals lessens the malleability, and as the leaf is sold by superficial measure, and not by weight, adulteration is kept at the minimum. The pure gold having been brought to the desired color by the addition of silver or copper, it is cast into ingots three-fourths of an inch wide and of two ounces weight. These ingots are passed between polished steel rollers and flattened out into a ribbon of one-800ths of an inch thick. It is annealed, and cut into pieces one inch square. The metal is now about ready for the merciless hammering it is to receive from the gold-beater, who prepares a pile of 150 leaves of the metal in layers, with leaves of vellum, and encloses the whole mass in a double parchment case. Now, with a 16-pound hammer he beats the pack until the inch pieces are increased to four inches square. The next movement is to remove the leaf, divide it into four parts, and prepare another pile or pack, this time using gold-beaters' skin instead of vellum, and enclosing it, as before, in a parchment case. This pack is beaten with an 8-pound hammer; another quartering produces 2,400 leaves, having an area of about 190 times that of the ribbon, or a thickness of about one-200,000ths of an inch.

The marvelous malleability of gold is proven, when it is stated that an ounce of it has thus been beaten out, or extended, to a surface of nearly 100 square feet.

The beating causes ragged edges, which are cut away and, as "scrap," are again subjected to the mauling process.

After the last beating, the leaf is handled by means of wooden pincers, laid on a cushion, blown out flat and cut into squares of 3½ inches; 25 of these make what is known as a book. The leaves of the books are rubbed with red chalk to prevent the gold from adhering. The application of machinery to gold-beating has been attempted, but it appears with indifferent success.

THE NEW YORK AND BROOKLYN BRIDGE has already cost $13,000,000, and it is promised that it will be completed within a year if another million is furnished.

$14,000,000 seems an immense sum to expend for a bridge connecting two cities, when it is remembered that it would construct and equip over 600 miles of railway at an average cost of $23,000 per mile.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

NEW YORK CITY BUILDING ITEMS.

A building, to be used for a chemical laboratory by the College of the City of New York, is to be erected at a cost of $10,000.

Charles Riley is going to build seven four-story and basement brown stone houses, each 20 by 65 feet, on the southeast corner of Lexington avenue and Ninety-fourth street.

Frank Work, the well-known Wall street broker, proposes to erect a handsome private residence and stable on the south side of Sixty-third street, 100 feet west of Eighth avenue.

S. C. Thompson, President of the Chase National Bank, proposes to erect a palatial residence on a plot of ground recently purchased by him on the northeast corner of Seventy-seventh street and Riverside Drive.

G. W. Da Cunha is at work on plans for a stone building to be erected on Harrison street, between Hudson and Greenwich streets, for Henry Heide. It will be of brick with stone trimmings, 40 by 100 feet, and is to cost $30,000.

The high price of labor is interfering materially with building operations in all our adjacent cities. In Jersey City building has almost come to a standstill. A number of Brooklyn builders are making contracts to build in this city.

Adolph Kuttroff has commenced the excavation of the lot on the northwest corner of Madison avenue and Sixty-ninth street, where he proposes to erect a private residence in keeping with the magnificent improvements now being completed in this locality.

Munch & Loehr are erecting three four-story brick and brown stone flats on One Hundred and Eighteenth street, east of Pleasant avenue, one of the best streets in Harlem. They will be fitted throughout with all modern improvements, and will have eight rooms on each floor.

On the northeast side of One Hundred and Twenty-third street, 300 feet east of Eighth avenue, James Gault is about to erect six three-story and basement brown-stone front private residences, 16.8 by 50 feet, from designs by J. H. Valentine. They will cost $10,000 each.

G. W. Da Cunha is preparing the plans for a six-story brick storehouse, to be erected on Franklin street, between Hudson street and West Broadway, and running through to Leonard street. It will be 50 by 110 feet, and is to cost $40,000. F. Bechstein is the owner.

Munch & Albrecht are erecting two four-story high-stoop brown stone flats on the north side of One Hundred and Sixteenth street, east of Second avenue. They are well built, are finished in hard wood, and contain the most approved methods for ventilation, etc. Each floor contains eight fine rooms.

On the site of the old Walton House, erected in 1751, at 234 and 236 Pearl street, James Callery will erect two stores, 25 by 85 feet and five stories in hight, from designs by William Kuhles. The fronts are to be of iron and brick. The entire cost will be from $30,000 to $35,000.

On the northeast corner of Madison avenue and One Hundred and Twentieth street there are to be six three-story brown stone dwellings. The cost of each is to be $25,000, $45,000 and $50,000—total, $120,000. Mrs. Lottie N. Dean is the owner, R. Rosenstock the architect, and H. N. Dean the builder.

Charles Baxter is about to build a fine block of stores on Fourth avenue, between One Hundred and Twentieth and One Hundred and Twenty-first streets. There will be eight stores with flats above, each 25 by 65 feet and four stories high. They will be built of brick with stone trimmings, and are to cost $100,000.

Lespinasse & Friedman, it is said, are about to erect an extensive apartment house on the plot of ground on the east side of Ninth avenue, between Seventy-second and Seventy-third streets, 200 feet on the avenue, 46 feet on Seventy-second street, and 51 feet 2 inches on Seventy-third street.

Hugh Blesson will soon commence the erection of a five or six story apartment house, 50 by 90 feet, on the two lots on the north side of Fifty-eighth street, 150 feet east of Ninth avenue. They will be built of brown stone, brick and terra-cotta, and will contain all the latest improvements.

J. C. Burne is engaged on the plans for two extensive four-story brown stone flats with stores, which will be erected on the southeast corner of First avenue and Seventy-ninth street. They will be 27 and 28 feet front and 80 feet deep. Andrew Kelly, the owner, expects to expend $36,000 on this improvement.

Babcock & McAvoy are drawing the plans for an enamel works for the J. L. Mott Iron Works. The building will be erected on One Hundred and Thirty-seventh street, west of Third avenue, and will be two stories in hight, built of brick, 60 by 100 feet, and is to cost about $10,000. The building will be built upon a pile foundation.

C. Graham & Sons will commence at once the erection of six first-class dwellings on the plot of ground on the south side of Thirty-seventh street, commencing 80 feet east of Lexington avenue and opposite to the row of houses recently completed by them. The cost of this improvement will reach $175,000, including the price of the ground.

On the northeast corner of Seventy-third street and Fourth avenue, C. H. Bliss is about to erect a six-story apartment house, 40 by 86 feet, and three houses on the street, 22 by 86 feet, and five stories high. They will be constructed of brick and brown stone, and are to cost $100,000. Thom & Wilson are the architects.

Terence Farley will build three private residences on Seventy-fifth street, near Madison avenue. One is to be 15 by 56 feet, and the other two 18 by 56 feet. They will have dining-room extensions and be four stories in hight. They will have brown stone fronts, and are to cost $45,000. Thom & Wilson are the architects.

The corner-stone of the Liederkranz Society's building, to be erected in Fifty-eighth street, between Park and Lexington avenues, has been laid. The building is to measure 100 by 125 feet. It will be three stories above the basement. The cost will probably be about $100,000. Kuhles & Schwarzmann are the architects.

William Pickhardt is building a handsome residence at Seventy-fourth street and Fifth avenue. It will be six stories in hight, with a basement, a cellar, and a sub-cellar, making nine stories between roof and foundation. To balance the hight above the curb—120 feet—there will be a breadth of 52 feet and a depth of 125 feet. The depth below the curb is 26 feet. The cost is estimated at $290,000.

J. B. Snook has completed the plans for the Fourth avenue car stables, which are to be erected on the same site as those that were recently burned—viz., Fourth avenue to Lexington avenue and Thirty-second to Thirty-third streets. They are to be materially the same as those destroyed, and will be built of brick, two stories in hight on Fourth avenue and three stories on Lexington avenue. They will contain stalls for 1,100 horses, and a blacksmith-shop 28 by 70 feet.

The Board of Managers of the Home for Aged and Infirm Hebrews, now situated at Eighty-seventh street and Avenue A, have adopted the plans of D. & J. Jardine, architects, for the new building which is shortly to be erected for the Home on the west side of the city. Work on it will commence as soon as a few other preliminary details can be arranged. Of the $150,000 which are considered necessary in order to carry on the enterprise successfully to completion, the sum of $92,000 has already been collected, and subscriptions continue to be received.

Edward Clark is about to commence the erection of more than thirty four-story and French roof brick dwellings on the plot of ground on the north side of Seventy-third street, commencing at a point 200 feet west of Eighth avenue and extending to the easterly side of Ninth avenue, 600 by 100 feet. They will vary in width, some being 18 feet 9 inches, some 20 feet, and some 25 feet; the uniform depth will be 60 feet. They will all front on Seventy-third street, and be ornamented with variegated stone. Although the plans have not yet been drawn for the houses, it is understood that H. J. Hardenburgh will be the architect.

The large warehouse on the corner of West and Murray streets, which is now being completed for Mr. Renwick, who represents the old Rhinelander estate, is built of brick and Wyoming Valley stone, the brick being laid in red mortar, with dentile and other projective courses. The chief points of interest, however, are the cellar, which is 4 feet below high-water mark, and the walls, which were carried down 16 feet 6 inches below the curb, in order to do away with the driving of piles. It was a common remark during the erection of this building, that it would never get out of the hole, as it looked as if it were standing on water; but now the latter has all been pumped out, the mud excavated, and a patent cellar-bottom put in. While the work of excavation was going on for this building, the original beach bottom was struck and a portion of an old dock was discovered, the existence of which can still be remembered by a few of our oldest inhabitants.

MISCELLANEOUS.

A casino, 80 by 80 feet, will soon be built on lands recently bought by C. Wyliss Betts, at Southampton Beach, L. I.

A new chapel will be erected to the memory of Bishop Berkley at Newport, R. I. It will cost $100,000, and is to take the place of All Saints Chapel.

The members of the Jones Methodist Episcopal Church, located in Reid street, Brooklyn, N. Y., have just raised $7,000 with which to build a new church.

It is the intention of the Jersey City Board of Police Commissioners to erect a new city hospital on the property purchased by them on Baldwin avenue, near Montgomery street.

Work has just commenced on the new depot for the Rochester & Pittsburgh Railroad on West Main street, Rochester, N. Y. The building is to be completed in the shortest possible time.

A depot is to be built at Dedham, Mass. It is to be 60 by 60 feet, with a tower 60 feet high. The material will be brick and Dedham granite, with finish of brown stone. Work upon the superstructure is to be commenced immediately.

The Royal Insurance Co. have commenced to build an office building on Third street, below Walnut street, Philadelphia, size, 26 by 101 feet. The front building is to be five stories high, and the back building four stories high. James P. Sims is the architect.

Plans have just been completed for three houses to be erected at Long Branch, by Samuel Harris, of New York, at a total expense of $21,000. John E. Baker is the architect. He is also drawing designs for four cottages for N. Depeyster, which are also to be erected at Long Branch.

A new hospital building is to built at Sailors' Snug Harbor, Staten Island. It will be three stories in hight, 156 feet long and 52 feet high. On the south end will be a sun bath-room 12 by 10 feet, and on the west end a smoking-room 16 by 18 feet. It is expected that this building will be completed by next summer.

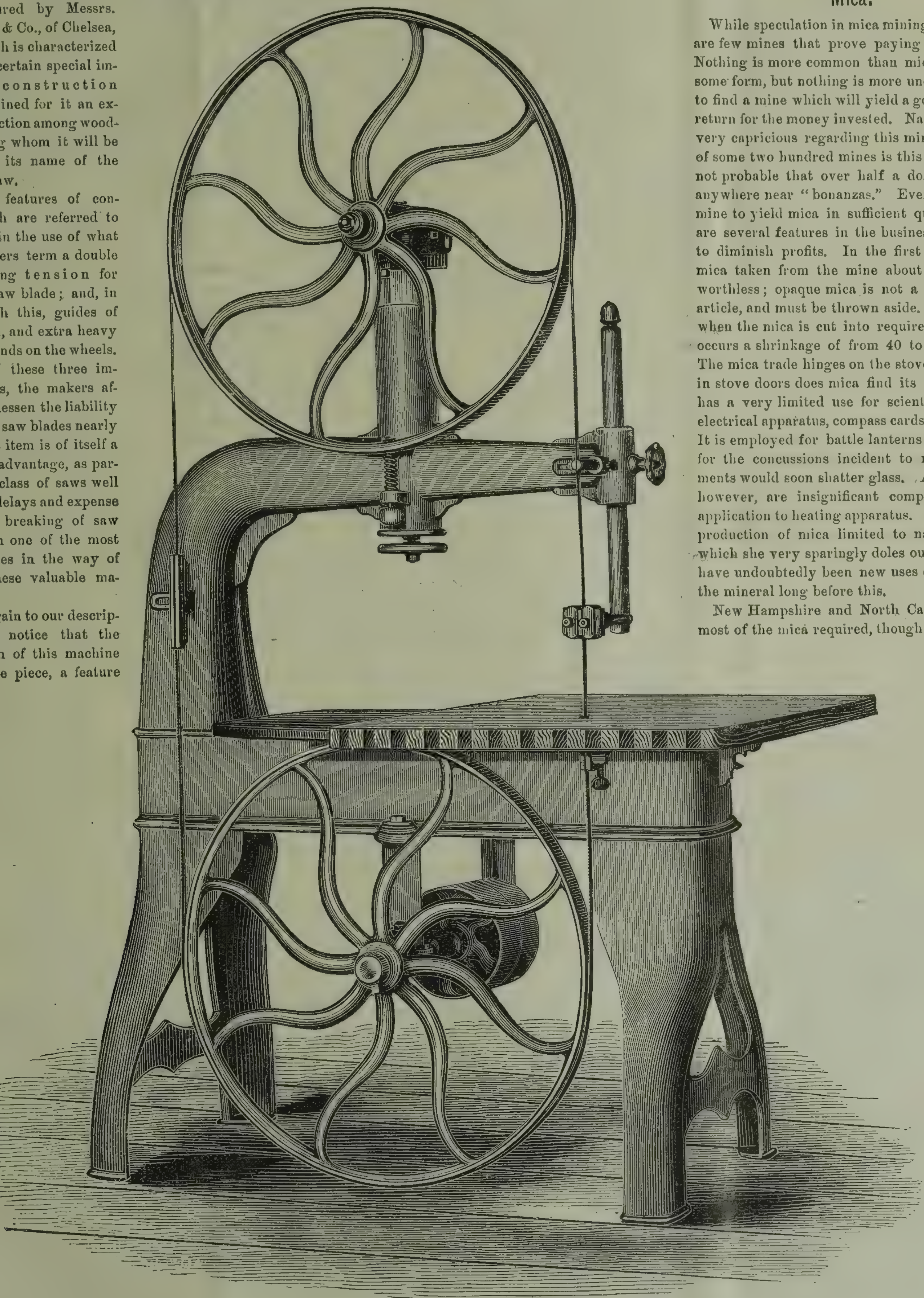
A two-story brick bank building, measuring 38 by 44 feet, is being built on Prospect street, Thompsonville, Conn., for the Thompsonville Trust Co., at a cost of $5,000. E. Smith Warren, of Springfield, Mass., is the architect, and Abner Woodward the builder. Work was begun August 1st, and will be finished December 1st.

The Eclipse Band-Saw.

The illustration shown in connection with this article represents a perspective view of an improved band-saw manufactured by Messrs. S. K. Lovewell & Co., of Chelsea, Mass., and which is characterized by possessing certain special improvements of construction which have gained for it an extensive introduction among wood-workers, among whom it will be recognized by its name of the Eclipse band-saw.

The special features of construction which are referred to above, consist in the use of what the manufacturers term a double adjustable spring tension for straining the saw blade; and, in connection with this, guides of superior design, and extra heavy india rubber bands on the wheels. By the use of these three improved features, the makers affirm that they lessen the liability of breaking the saw blades nearly one half. This item is of itself a very material advantage, as parties using this class of saws well know that the delays and expense attending the breaking of saw blades has been one of the most serious obstacles in the way of introducing these valuable machines.

Returning again to our description, we may notice that the frame and arm of this machine are cast in one piece, a feature which, by avoiding all joints and bolts, insures adequate and uniform strength throughout the machine. Another noteworthy feature is the novel construction of the box for the upper wheel shaft, by which the operator is enabled to tip the wheel to any desired angle. The lower wheel can also be moved on the shaft, so that the saw can be made to run on any part of either wheel, and thus prevent the wearing of the bands out of true. The other portions of the machine embody substantially the same elements that are recognized by the best makers as standard. It has 36-inch wheels; 12-inch pulleys; carries a 19-foot saw, from $\frac{1}{8}$ to $1\frac{1}{2}$ inches in width; saws 13 inches in thickness; swings 31 inches; has table either of iron or wood, as desired, 34 inches square; weighs 750 pounds, and should run about three hundred and fifty turns per minute. Further particulars may be had by communicating with the manufacturers.



THE ECLIPSE BAND-SAW.

Mica.

While speculation in mica mining is rife, there are few mines that prove paying investments. Nothing is more common than mica deposits in some form, but nothing is more uncommon than to find a mine which will yield a good profitable return for the money invested. Nature has been very capricious regarding this mineral, and out of some two hundred mines is this country, it is not probable that over half a dozen approach anywhere near "bonanzas." Even suppose the mine to yield mica in sufficient quantity, there are several features in the business which tend to diminish profits. In the first place, of the mica taken from the mine about 5 per cent is worthless; opaque mica is not a merchantable article, and must be thrown aside. Afterwards, when the mica is cut into required sizes, there occurs a shrinkage of from 40 to 60 per cent. The mica trade hinges on the stove business, for in stove doors does mica find its chief use. It has a very limited use for scientific purposes, electrical apparatus, compass cards, lanterns, etc. It is employed for battle lanterns on war ships, for the concussions incident to naval engagements would soon shatter glass. All these uses, however, are insignificant compared with its application to heating apparatus. Were not the production of mica limited to nature's stores, which she very sparingly doles out, there would have undoubtedly been new uses discovered for the mineral long before this.

New Hampshire and North Carolina furnish most of the mica required, though deposits exist over a wide stretch of territory, and the mineral has been found as far West as the Rocky Mountains. The Indians were acquainted with it, and used it for ornaments to adorn their persons, and for mirrors to reflect their dusky charms. On opening a mine in North Carolina some years ago, a copper instrument,

supposed to be at least three hundred years old, was found. There has been much small mica thrown on the market in recent years, and prices of this kind have declined, but large mica, being scarce, maintains its price. The number of farmers in Maine, New Hampshire and Vermont who have discovered mica deposits on their estates, and who have seen prospective wealth therefrom, is legion, but the number who have really profited by their discoveries is very small.

The Early Days of Bessemer Steel.

Under this title, the London *Engineering* of a recent date gives a concise history of Sir Henry Bessemer's struggles which resulted, as the world now well knows, in the production of malleable iron in a fluid state, which was cast into molds and rolled into bars. It is the old story over again, and ever interesting. When Mr. Bessemer, by the advice of Mr. G. Rennie, the President of the Mechanical Section of the British Association, read, on the 13th of August, 1856, his paper on "The Manufacture of Malleable Iron without Fuel," practical men were prepared to treat the whole affair as a joke, and eminent manufacturers of iron came to enjoy the fun and to ridicule the author of the "absurd" proposition.

But it was a case of coming to scoff and remaining to pray. One iron master offered to place his works at Mr. Bessemer's disposal for experiments. "Mr. James Nasmyth, who was present, in his appreciative enthusiasm, held up at arm's length one of Mr. Bessemer's samples, exclaiming: 'Here's a true British nugget!' This identical bar of iron," says our contemporary, "is now before us; it was rolled, cut, piled and re-rolled at Woolwich Arsenal, and fully proves the soundness of the principle on which the invention is based." The London *Times* reprinted the paper the morning after it had been read, and three days later a formal offer of $250,000 was made for the English patent, which was declined. A month after the appearance of the paper in the *Times*, $140,000 had been received for licenses to use the invention in Great Britain alone.

Then came a reaction, trials hastily made at various works having ended in a fiasco. "A brilliant meteor had flitted across the metallurgical horizon, dazzling all beholders for a moment, only to die out and leave no trace behind." Although this might be the general opinion, as voiced by one journal, it was not quite that of Mr. Bessemer, who at once set to work. At the end of three years, "steel of excellent quality was made from molten pig iron in fifteen minutes, wholly without the employment of skilled labor, or manipulation of any kind, and without the employment of fuel."

Another illustration of the irony of life is found in the fact that when Mr. Bessemer, having thus finally triumphed over every difficulty, read his second paper on "Iron and Steel" before the Institute of Civil Engineers, on May 24th, 1869, with the evidence of practical success before all in various and beautiful specimens, the merits of the invention were stoutly denied and the process was ridiculed by members present. Hostile critics were, Mr. Bramwell, Mr. T. Brown, Mr. T. M. Gladstone and Mr. Riley. The Sheffield steel-makers would not give the process a trial; and it was not until Mr. Bessemer determined to erect steel works at Sheffield and undersell the steel-maker in his own market, that the Bessemer process was introduced. In Great Britain alone, the quantity of steel produced in 1880 was a little over twenty times the entire production of steel in that country prior to the invention. A remarkable fact, which will undoubtedly be mentally commented on by all thoughtful readers without any suggestions from us, will be found in the final statement of our authority, that for twenty-five years, owing to the clamor of interested or ignorant partisans, the original paper has been excluded from the Transactions of the British Association.

Clock Dials.

The dials of American clocks are usually made of sheet metal—zinc or iron—cut to shape. The front side is painted with white paint called enamel. The metal is heated slightly during the process. When dry, the circles for the minutes are struck with a paint brush, the dial being mounted on a turn-table and revolved, the brush being meanwhile held against a rest. A stencil plate is laid on the dial to mark off the position of the hours; or, in some cases, these are divided by the eye alone. The paint used is lampblack mixed with copal varnish to a proper consistency. To give it brilliancy, the painting is dried in an oven. Practiced hands can paint in the Roman numerals at their correct places without any marking. They use a fine brush for the fine lines, and a larger one for the thick ones. The minutes are also all painted in and spaced by the eye. The ordinary twelve-inch clock dial is enameled and painted at a cost of about 25 cents. Women are employed for the work, and with practice attain great speed and accuracy. Dial painting entails the use of a certain plant, and it forms one of the many branches into which the clock and watch trades are divided.

An Electric Elevator.

Of the numerous applications of electricity, which of late have multiplied with astonishing rapidity, not the least interesting and novel is its employment as the motive power for elevators; and to judge from the success that has attended the first efforts of inventors in this direction, it is highly probable that this application of the agent may develop in time into considerable importance.

The first elevator actuated by electricity ever placed in actual service, was constructed, it is claimed, by the celebrated makers of electrical appliances and machinery—Messrs. Siemens and Halske, of Berlin. It was built for a look-out, some 60 feet high, at the Industrial Exhibition in Mannheim, Germany, during the early part of the present year. This elevator was found to answer its intended purpose very satisfactorily, and was in operation throughout the entire progress of the exhibition, during which it safely transported 8,000 persons up and down.

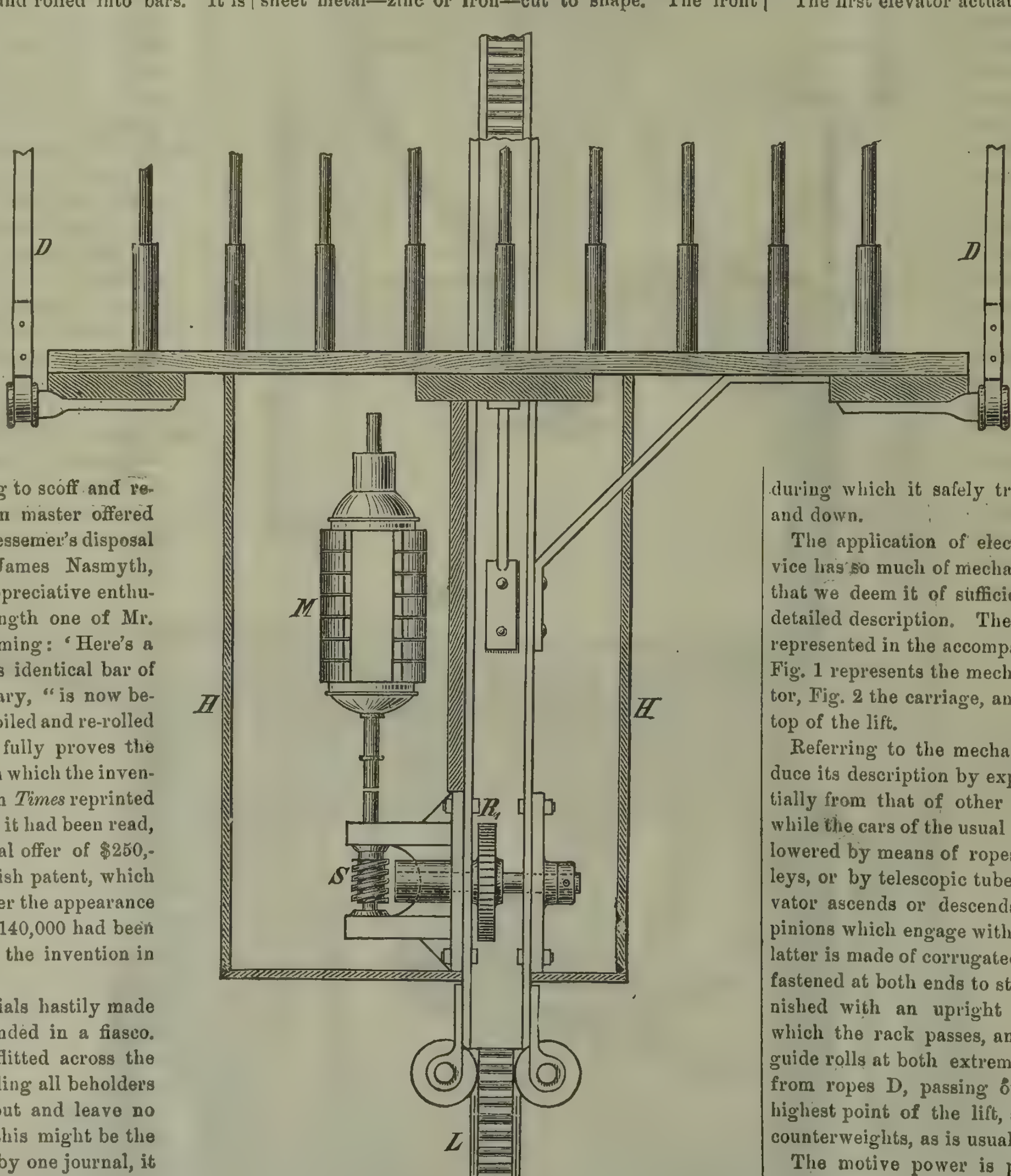


Fig. 1.—The Electric Elevator Mechanism.

The application of electricity for this special service has so much of mechanical interest attached to it, that we deem it of sufficient importance to warrant a detailed description. The apparatus here spoken of is represented in the accompanying engravings, in which Fig. 1 represents the mechanism of the electric elevator, Fig. 2 the carriage, and Fig. 3 the elevator at the top of the lift.

Referring to the mechanism (Fig. 1), we may introduce its description by explaining that it differs essentially from that of other elevators in the fact, that, while the cars of the usual constructions are raised and lowered by means of ropes or cables passing over pulleys, or by telescopic tubes, the car of the electric elevator ascends or descends by the movement of two pinions which engage with the rack or ladder L. The latter is made of corrugated sheet steel, and is securely fastened at both ends to strong beams. The car is furnished with an upright cylinder or tube, through which the rack passes, and which has also a pair of guide rolls at both extremities. The car is suspended from ropes D, passing over two pulleys above the highest point of the lift, and balanced by adjustable counterweights, as is usually the case.

The motive power is placed entirely beneath the platform of the car and enclosed in a box H, Fig. 1. It consists substantially of the electric motor M, carrying on the lower extremity of its shaft the worm S. This engages with two intermeshing pinions, on the shafts of which are placed two gear wheels R R (one of which is visible in the cut), which engage with the teeth of the rack L on opposite sides of the same. A dynamo-electric machine at the engine house supplies the power for actuating the electric motor M, the electric connections being formed on one side by the rack L, and on the other by the suspension cables D. A hand lever, controlled by the operator, serves to throw the current on or off, and thus raise, lower or stop the carriage. The current is automatically thrown off when the car arrives at the top or bottom of its run.

This elevator is claimed to realize very fully the conditions of safety. Should a rope break, the result would simply be the stoppage of the car, as the pitch of the worm wheel is so small as to present great re-

sistance to its movement in the opposite direction; while, on the other hand, the balance weights would prevent the car from sudden descent should the rack or toothed wheels give way.

The construction is worthy of attention by our mechanical readers, as representing an interesting and novel application of electricity.

Fuller's "Common Sense" Drying Apparatus.

We availed ourselves lately of an opportunity to examine the practical working of this system of drying lumber, as it is operated in the large furniture manufactory of Herts Brothers, No. 163 West Eighteenth street, this city, and find that the favorable opinion we have expressed in former articles concerning the theory and practice of the apparatus, are in all respects justified by its performance. The appearance of the seasoned lumber on the opening of the desiccating chamber, showed it to be remarkably free from warping and splitting, or checking, as it is technically termed,

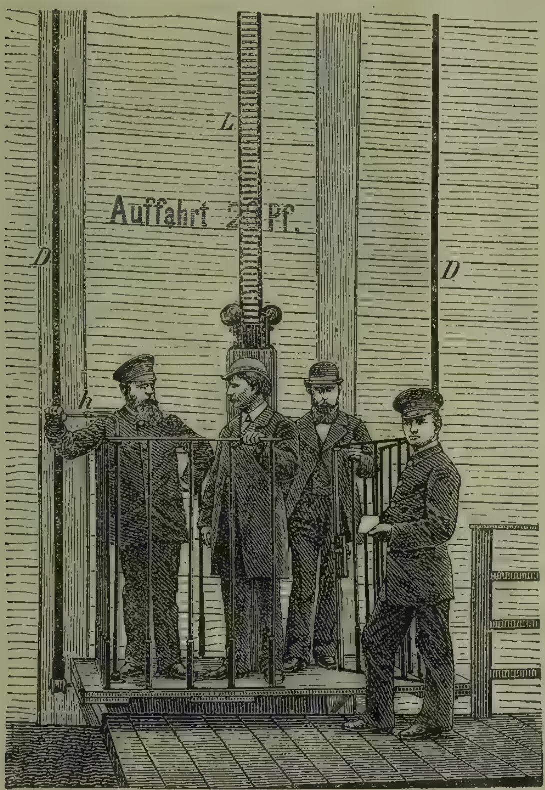


Fig. 2.—Electric Elevator Carriage.

both of which troublesome consequences cannot be wholly avoided with the old process employing a hot chamber and ventilation, even where the utmost care and skill are employed. The proprietors of this extensive establishment expressed themselves as thoroughly satisfied of the value of the Fuller drying apparatus, representing to us unqualifiedly that it completely does away with the annoyance and waste caused by the warping and checking which is inseparable from the system in common use, and added, further, that the new apparatus materially shortened the time required for seasoning, which was also a very decided advantage.

A brief rehearsal of the peculiar features of the Fuller "Common Sense" drying apparatus may be of service to those of our readers who may not have access to our previous notices.

The usual process of seasoning lumber consists simply in employing hot air and ventilation. Mr. Fuller modifies this plan by providing simple means for drying the air before it enters the drying chamber. By this simple artifice two important advantages are accomplished; first, the air forced into the chamber, being desiccated, has its capacity for absorbing moisture from the wood materially increased over that possessed by the more or less saturated air taken from outside in the usual operation; and second, owing to this increased absorptive capacity for moisture, the temperature of the chamber required to effect the rapid drying out of the lumber is only very moderate. This last feature is of importance in preventing the warping and splitting of the wood.

Mr. Fuller's apparatus has the following construction: The drying room consists of a close chamber of any desired capacity, in which the lumber to be seasoned is stacked, each piece being separated from the contiguous one above and below by several blocks of the same thickness as the boards themselves, thus providing that the entire surface of the boards shall be accessible for ventilation and steaming. This chamber is heated by a system of steam pipes placed upon a tight flooring at the bottom of the chamber. The air, before being admitted into the drying room, is made to pass through a cylindrical chamber called a condenser, which is kept at a low temperature with the aid of a stream of cold water that is constantly flowing through a coil placed therein. In its passage through this cooling chamber, the heated and moisture-laden air drawn from the drying room by means of an exhaust fan and suitable connecting pipes, is chilled, and deposits the bulk of its moisture in the condenser, (from which it flows away in a constant stream through a waste pipe), and is then forced to enter the drying chamber again through a perforated pipe passing about the sides of the chamber near the bottom. Here the cold and desiccated air is rapidly heated, and its capacity for moisture being greatly enhanced, it speedily loads itself with water from the porous lumber, and after making the circuit of the chamber, is drawn out by the action of the exhaust through an eduction pipe at the top of the chamber, and again passes through the condenser, to go through the same process. The same air is thus made to do duty over and over again.

This system can be adapted to drying many articles besides lumber, as, for example, wool, cotton, grain, chemicals and the like. For drying lumber, however, it has shown itself to be admirably adapted. The apparatus is manufactured by the St. Albans Manufacturing Co., of St. Albans, Vt.

How to Tell Good from Bad Gilding.

It may be ascertained whether gilding is genuine or not by the fact that on the latter a weak solution of protochloride of copper produces a black precipitate, which it does not on the former. In the case of gilt paper, the simplest method consists in slowly burning the paper in a bright flame that gives out no smoke; in the incinerated remains of good gilt paper there are traces of the gold left behind, which are quite perceptible to the naked eye, in the shape of glittering spots, while base metal on paper oxidizes in burning, and leaves nothing but a lot of red spots behind. This method, however, is scarcely accurate enough; a very much safer test is to be found in the use of mercury, either in metallic shape or in solution of salts of mercury. The former test is performed by putting a few drops of pure quicksilver on the gilt article, and either rubbing it in or slightly heating it. If the gilding be genuine, though ever so thin, the mercury combines itself with it, producing white spots on the surface. This does not occur in the case of sham gilding, and in rubbing mercury in no change of color whatever can be noticed. Another test consists in the application of a watery solution of nitrate of mercury. In this case the exact opposite takes place as in the former, for genuine gilding remains intact, while a "duffer" at once takes a white color when brought in contact with the precipitate of mercury.

Birch-Bark Rubber.—A French chemist has obtained a dense black gum from the outer layers of the birch-tree bark by distillation. It possesses all the ordinary properties of gutta-percha, and has the additional merit of resisting the deteriorating influence of air and the corrosive action of acids. This advantage makes it useful as an ingredient of india-rubber and gutta-percha, which it is said to render far more durable.

Economical Use of Steam Power.

The *Mechanical Engineer* remarks very forcibly: "If consumers of power will take the opportunity some time in warm weather, to ascertain what portion of their engine power is used in merely driving the shafting with no work attached, they will doubtless make a discovery that will surprise them. We say in warm weather, for the reason that in cold many lines are so exposed that the stiffening of the lubricators employed has a marked effect on the result. The test is simply

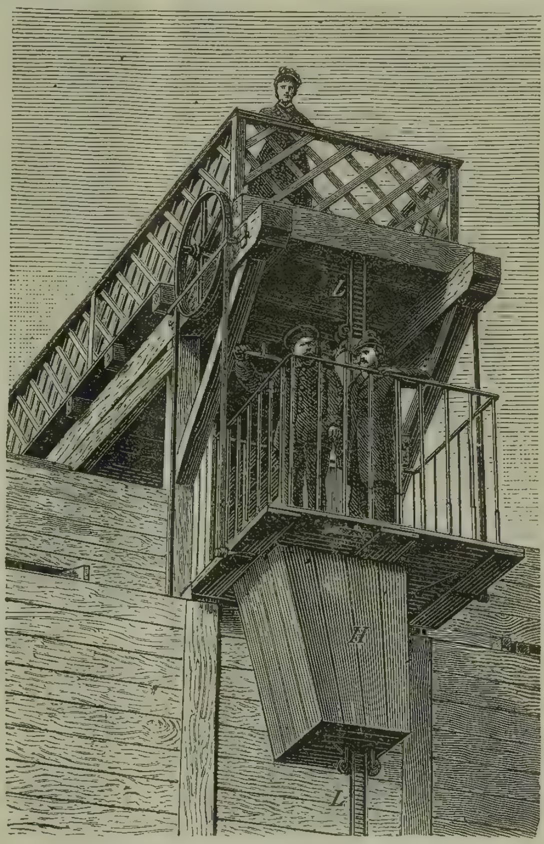


Fig. 3.—Elevator at Top of its Lift.

that of the steam gauge, without an indicator or calculations. Year in and year out the line runs, and so long as the belts stay on the pulleys no attention is given. Steam is raised in the morning to full working pressure, and the machinery is not started until the regular hour; but if the steam is raised say only to five or ten pounds and the engine tried, it will be found in many cases that it cannot be moved. It needs no argument to prove that half the steam pressure should not be needed merely to overcome the friction of the line; but a very small percentage is required; what that may be is determined by circumstances. We do not assert that this test may be used in place of the indicator, for it only shows approximately the steam required to move the engine and shafting; but that it is good so far as it goes no one will dispute. In general terms, not five per cent of the working pressure in the boiler should be needed to overcome friction—say $2\frac{1}{2}$ to 3 pounds in 50 pounds; but this is only possible where everything is in perfect order. In by far the majority of factories it will be found that over ten per cent of the steam pressure is lost in moving the parts.

To Wind a Watch, turn the hole downward, and let the small end of the key point upward. This will allow any little particles of dirt, metal or dust to drop out, and the watch will not need cleaning so often.

Holding Power of Tubes in Steam Boilers.

In a recent issue of the *Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Co., the holding power of tubes when rolled into the tube sheet with the Dudgeon expander, was the subject of discussion, and it was shown from experiment that when the work was well done, the holding power was something more than five times the ordinary internal pressure tending to drive the tube sheet outward. The following article is a further contribution to the subject, from the same excellent source:

So much depends upon the proper use of the Dudgeon expander, that some mechanical engineers are quite reluctant to accept the theory that all tubes thus rolled in are equally effective in sustaining the head, or tube sheet. This criticism is in a measure true, and hence all boiler-makers who have pride in their work and regard for their reputation, should know that this work is well done. The riveting over of the ends of the tubes is generally practiced, and when well done makes a very strong joint; but those who are familiar with this kind of work, know that in many cases the

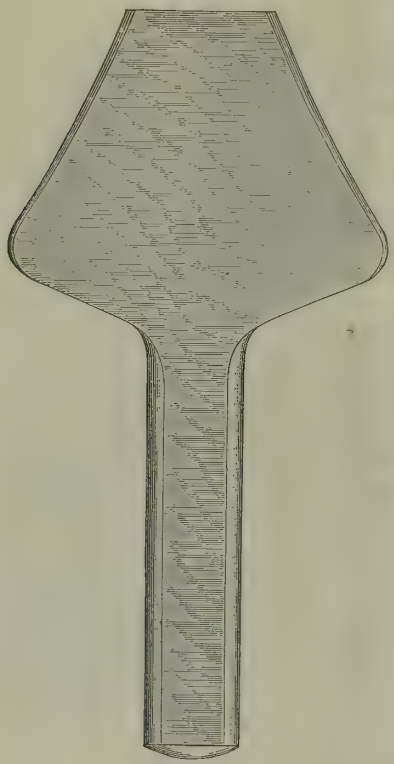


Fig. 1.

ends of the tubes are frayed out and split, and until the "thumb tool" is brought to bear the job has a very unpromising look. Such work yields readily to the action of the heated gases, and after a time the riveting or beading fractures and crumbles off, and very little strength remains. This fraying and cracking is sometimes attributed to a want of proper annealing of the ends of the tubes, but it is quite as often the result of unskilled workmanship. We have seen it so often that we are never sure that it is well done.

Another method of fastening tubes into the tube sheet, and one that, so far as we have investigated, works well—the test being boilers in use—is to adjust the tubes so that they shall project slightly beyond the tube sheet. Roll them in with the Dudgeon expander, and then with one of the tools shown in Figs. 1 and 2, flare, or further expand, the projecting ends. Figs. 3 and 4 show the above tools in cross section. Little explanation of the manner of using them is necessary. After the tubes are rolled in, either of the above tools can be used for expanding the ends. Some prefer the tool with two points of contact, and others use the one with three. The tool is inserted into the end of the tube and driven with a hammer until the end of the tube is brought solid against the tube sheet. Only light blows are required, and the workman can readily tell when the expanding is sufficiently done, Fig. 5 shows a tube which has been expanded by this method.

In order to ascertain what the holding power of tubes set in this manner would be, it was arranged with H. B. Beach & Sons, boiler-makers in Hartford, Conn., to prepare for the Hartford company two specimens for test. They were tubes three inches internal diameter, rolled into ⅜-inch plate and expanded as de-

Fig. 3.

scribed above. These specimens were handed to Mr. Charles B. Richards, Consulting Engineer at the Colt's armory in Hartford, with the request that he submit them to the required test. The following is Mr. Richards' report:

"*Report by the Colt's Patent Fire-Arms Manufacturing Company of tests of the holding strength of two boiler tubes expanded into iron plates:*

"The external diameter of the body of the tube was 3 inches, and the thickness 0.109 of an inch. One end of the tube was fastened in an iron plate ⅜ of an inch thick and 6 inches square. The tube was fastened in the plate by being expanded, and the end of the tube, which projected three-16ths of an inch beyond the plate was flared so that the external diameter of the extreme end was 3.2 inches, while the diameter of the tube where it entered the plate was expanded to 3.1 inches in diameter. The test was made by observing the stress required to draw the tube out of the plate, but the tube was not wholly removed from the plate in specimen No. 1,079. Both samples were originally alike, so that the description of one of them answers for both. The stress which was sustained without the tube yielding in the plate, was,

For specimen 1,078, 20,000 pounds.
For specimen 1,079, 18,500 pounds.

"The observed stress which first produced yielding, was,

For 1,078, 20,500 pounds.
For 1,079, 19,000 pounds.

"And the observed stress which occasioned failure, was,

For 1,078, 21,000 pounds.
For 1,079, 19,500 pounds.

"The force was applied parallel to the axis of the tube, and the plate surfaces were held in planes at a right angle to the tube axis."

From the foregoing, it will be seen that the observed stress which first produced yielding was 20,500 pounds, and 19,000 pounds. To ascertain what the holding power of the tubes in an ordinary tubular boiler 48 inches in diameter would be, we have to multiply the holding power of one tube by the number of tubes.

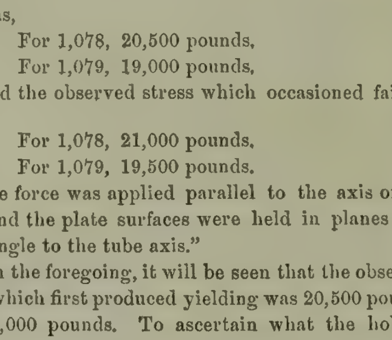


Fig. 4.

Fig. 6 represents the tube head of a 48-inch boiler. We will assume the lowest result of the experiments, namely, 19,000 pounds, as the holding power of one tube. In the tube head here represented there are 47 tubes, and $47 \times 19{,}000 = 893{,}000$ pounds, the holding power of all the tubes. It will be seen that these tubes are in the lower half of the boiler. The upper half is supposed to be thoroughly braced and stayed by stay-rods running back on the body sheets of the boiler. Consequently the tubes furnish the support for the lower half of the tube head. (We are not now taking into account the support derived from the joining of the flange of the head to the body of the boiler). To ascertain the actual resistance of internal steam pressure to be overcome and provided for, we first ascertain the area of the head in inches, and multiply it by the internal pressure per square inch. The area in square inches of a tube head 48 inches in diameter is 1,809.6 square inches. But we have already stated that the upper half is supported by braces and stays running back on the body sheets of the boiler, therefore only half the head is dependent upon the tubes for support, $1{,}809.6 \div 2 = 904.8$ square inches. Again, we find that the lower half of the head is largely taken up by the tubes, consequently the area upon which the internal pressure can act must be further reduced by the area of the tubes. The area of a 3-inch tube is 7.069 square inches, which, multiplied by $47 = 332.243$ square inches, $904.8 - 332.243 = 572.557$ square inches, the area of the lower half of the head upon which the internal pressure would act. We will assume the internal pressure

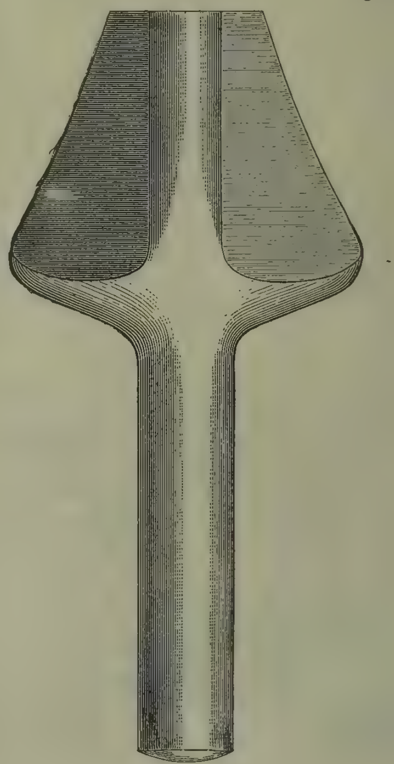


Fig. 2.

to be 80 pounds to the square inch, then $572.557 \times 80 = 45{,}804.56$ pounds, to sustain which we have the holding power of the tubes, 893,000 pounds or nearly 20 times the internal pressure on the lower half of the tube head. This, it must be understood, does not take into account the fact that the tube head is firmly secured to the body sheets of the boiler by its flange besides. Boilers with tubes set in this way have been under the care of the Hartford company for some years, and nothing has been seen to lead to the apprehension of any trouble. The ends have given little or no trouble by being subjected to the heated gases. The company do not recommend a projection of the tube beyond the tube sheet of more than ⅛ of an inch before expanding.

Strength of Cast-Iron Boiler Heads.

Messrs. Sidebotham & Powell, the firm that built the boiler which exploded last June at Philadelphia, have recently been experimenting with a view to determine the ultimate strength of a cast-iron head of the same dimensions of the one blown in pieces at that time. For this purpose they constructed a boiler similar to the one that exploded, except that it was not so long, and submitted it to hydrostatic pressure. The head gave out by cracking about half the distance across its surface, under a pressure of 450 pounds, the break commencing at a sand-hole previously noticed,

The experiment was made in the presence of quite a number of invited spectators, including the members of the coroner's jury who, it will be remembered, condemned the use of cast-iron heads in their verdict.

Explosion of a Flue Boiler.

BY F. B. ALLEN, M.E.

During the month of December, 1877, an explosion occurred in the city of ———, N. Y., that at the time attracted considerable local attention, from the fact perhaps that the boilers were in the same setting (Fig. 7), with an open steam pipe connection between them, without valves or cocks by which that connection could be closed, and the pressure increased on one boiler beyond the limits of its strength.

The factory in which they were used had been idle for some days previous, to take stock and make some necessary repairs, and little steam was needed. The fires were ordered to be kept very light, furnishing only sufficient steam to operate the pumps and prevent freezing up (the pressure necessary to do this was but 20 pounds, while the usual working pressure was 60 pounds). Under these circumstances, it was claimed, explosion occurred in No. 2 boiler from the collapsing of its flues. Fortunately no lives were lost, therefore no official investigation was required, and so far as known by the writer, no satisfactory explanation was ever offered.

The boilers were two in number, of the horizontal flue pattern, 5 x 30 feet, externally fired, containing two 20-inch flues (two-20ths of an inch); the shells were of $\frac{3}{8}$-inch iron, single-riveted; material and workmanship of fair quality. Concerning their strength, we shall say more hereafter. They were built to order, and had been in use about five years by the concern, an old established one, doing a large manufacturing business, having ample means to buy the best of everything they required, and no doubt they were willing to pay for a good article, or what they were led to believe was such, especially in one so important as a steam boiler.

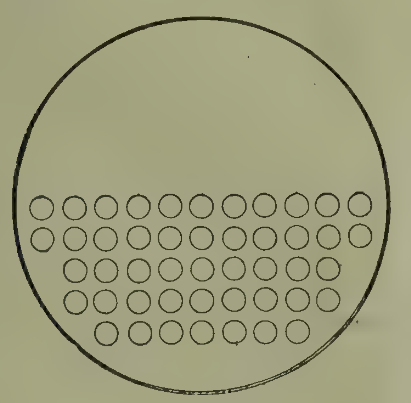


Fig. 6.

Referring to Fig. 7, it will be seen the steam drum, 28 inches in diameter by 25 feet long, was situated between the boilers, supported upon the middle wall of the setting, and that the steam pipes connected the boilers and the drum at both ends; *one safety valve* of of the common lever pattern, of 4 inches diameter, was attached to the drum, as were also the steam pipes to the engine and pumps. Aided by these details, it is hoped the reader will have obtained a general knowledge of the boilers, setting and connections, which are important in studying the possibilities of danger which they permitted—perhaps invited—our purpose in studying the history of this case.

It appears from the data furnished, the boilers were single-riveted upon their longitudinal seams, while the best practice for a number of years past has been to have them double-riveted when of so large diameter; the flues, of light $\frac{1}{4}$-inch iron, were dangerously weak for their size—namely, 20 inches inches in diameter. It appeared that they collapsed near the middle of their length, and extended to within a short distance of each head, rupturing at the front end, the effect of which was to unseat both the boilers, damaging them so badly that they were not afterward repaired, destroyed the setting, and injured the boiler-house and other buildings, the loss in all amounting to some $5,000. It was apparent from an examination of the collapsed flues that they had been overheated upon their most exposed part. The manner in which they yielded to the softening effects of this heat, flattening down on their top side, would confirm that opinion. It is a matter

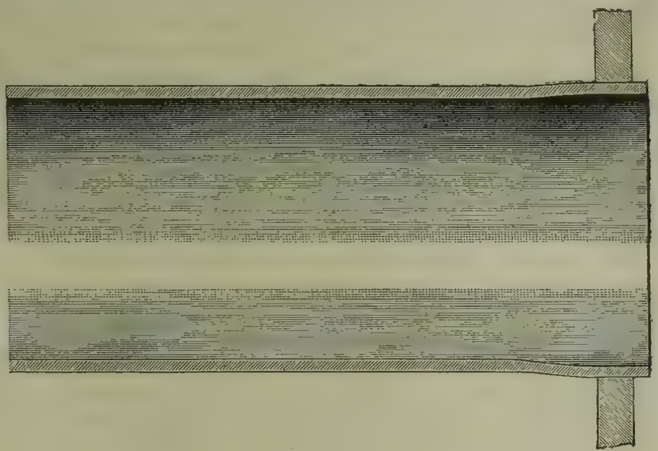


Fig. 5.

of conjecture as to what led to the overheating of these flues, whether neglect in attending to the feed, leaky blow-out, or by "kicking" into the adjoining boiler through the connections. I was informed each feed had its globe and check valve. If this was true, it is not likely it could have occurred in that way. At the time of the collapse (2 o'clock A.M.,) the boilers were in charge of the night watchman, who appeared dazed by the occurrence, but resolutely insisted it was through no fault of his. Possibly the arrangement of steam connections between the boilers would, under certain conditions, syphon the contents of one boiler into that of the other, if, for instance, one was heavily and the other lightly fired, or by the opening of one damper by which its fire was greatly accelerated, with the steam outlets from the drum shut off, as they were admitted to be at the time When water and steam from one boiler is violently driven over into that of the other, it is accompanied by a concussive jar, which does more or less damage according to the circumstances, not sufficient, it is thought, to have produced the effect here described.

The necessity for attaching a safety valve of sufficient area directly to the shell of each boiler without intervening valves, has been repeatedly urged in these columns, and the large number of boiler explosions that are traced to imperfectly connected safety valves, or those insufficient in area, prove this advice cannot safely be disregarded. Let us see what would have been a safety valve of sufficient area (it being assumed it has the lift and other requisites of a good valve). We have in round numbers about 549 square feet of heating surface in each boiler. According to the rules of the U. S. Steamboat Inspection Service—the only official authority in this country—this would have required a safety valve of not less than 5 inches for each boiler, while the fact was previously stated that there was but *one 4 inch safety valve for both boilers*, with an area of less than one-third that actually required, and that, too, not fully effective, owing to its location upon the steam drum.

The element of mystery in this case, as in many others, was the pressure of steam at the time of the explosion. In a recent case, 3 pounds of steam being the pressure last observed some five hours before, with fires banked, damper closed, and furnace doors open, it was assumed, and sought to be proved, that the explosion occurred at that insignificant pressure, forgetting that in a rational explanation of an unusual occurrence the cause shall at least be proved sufficient to account for the effect produced. Engineers and firemen are but human, and in common with the rest of mankind, occasionally leave undone important matters of every-day routine. A study of the charts from a recording gauge will materially assist in dispelling the mystery (so called) surrounding boiler explosions that occur at night and early in the morning. The reading of one of these charts shows that fires were banked at 6 P.M. for the night, *the steam pressure gradually accumulated after* 9.30 P.M. *until* 1 A.M., *when it indicated* 66 *pounds*, remaining at about that pressure until 6.45 A.M., when the engineer came, cleaned his fire, and possibly went to breakfast. At 7 A.M. it had reached 120 pounds, as recorded upon the chart. An illustration from my own experience may still further enlighten us concerning these mysterious occurrences. While at work upon a night repair job, my attention was attracted to an engine upon an adjoining "pit," that but an hour before had been put away for the night. Steam was leaking from a number of places upon the seams about the back head. Taking my torch to examine the steam gauge, I was surprised and alarmed to find it showed 180 pounds, the limit of its graduation, with the pointer jammed fast against the stop-pin. Easing the spring-balance, and allowing the valve to blow lightly, it was a minute or two before the pointer began its downward movement. Upon investigation, it transpired that the fireman, in violation of orders, had put away his engine with coals in the fire-box. "He was in a hurry," he said, "and didn't believe there was enough to amount to anything." Had an explosion occurred, what a mystery this case would have been, dwelling upon the fact that upon the engine during the day previous the working pressure had been 120 pounds, that it was filled with water and properly cared for, having

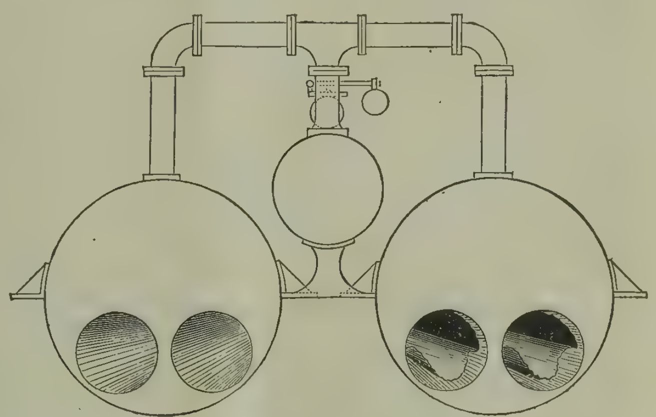


Fig. 7.

but 80 pounds of steam when put away, probably decreased to 50 pounds in a short time after—at some such pressure it explodes. Who could have revealed to us this terrible mystery? Yet how simple the explanation—neglect, the fruitful cause of a majority of explosions. In the Stevens' experiments at Sandy Hook, N. Y., in one of the boilers a wood fire, giving less heat than coal in an equal time, in thirteen minutes the pressure was raised from 30 to $83\frac{1}{2}$ pounds, the pressure at which explosion occurred, proving that a few minutes' absence of the engineer, or neglect, coupled with an inoperative safety valve, are all that is necessary to produce a most destructive explosion.

Judged in the light of experience, this explosion was probably chargeable to the neglect of the night watchman, who failed to keep up the water supply in No. 2 boiler, the tops of the flues were uncovered, and, becoming overheated, they collapsed with the effect pro

viously described. The pressure required to do this would not be an excessive one, owing to the weak construction of the flues. The safety valve was inadequate for the purpose, and its attachment made it unreliable. At the time of explosion, the steam pressure was probably in excess of its load of 60 pounds.

Wood Weaving.

We take the following details concerning a very peculiar industry from a recent number of *Cassell's Magazine:* One of the busiest towns of the manufacturing district of the Austrian empire is Ehrenberg, lying close to the Saxon frontier, and distinguished from other towns and villages for its curious industry of wood weaving—*sparterie* work, as it is called—which was introduced something more than a century ago by a carpenter named Anton Menzee. The threads used for weaving are no thicker than writing paper, and vary in width from one-fifth to the twenty-fifth part of an inch. The aspen is the only tree whose wood is sufficiently tough and pliable to supply these threads in the required lengths. This tree was formerly indigenous to Bohemia, but has now almost entirely disappeared, so that the raw material for the sparterie work has to be brought from Russian Poland. The wood used for the purpose of weaving must be free from knots, as the smaller defects or irregularity, such as ordinary persons would hardly notice, make the fibers quite unfit for working. Arrived in Ehrenberg, the wood is planed and divided into pieces nearly 2½ inches wide. When these have been made perfectly smooth, they are divided again by an instrument resembling a plane, but furnished with a number of fine knife blades, which mark the wood at regular distances, according to the width the strips are to be. This process requires the utmost dexterity and nicety, as it is absolutely essential that the divider shall exactly follow the direction of the fiber, and for this reason, among others, it must always be done by hand.

The divider makes incisions one-fifth of an inch deep; the wood is then carefully planed and comes off in thin paper-like strips, some of them not wider than a stout thread. They are gathered up by women as they fall, and are examined and the defective pieces rejected. There is a good deal of waste in the process. The threads or fibers being ready, must be tied in couples at one end before they can be woven. This work is done by children of four years of age and upward, who earn eight cents a day. The weaving is done chiefly by women, and on looms which differ considerably from those in ordinary use, the fiber being not more than 39 to 50 inches in length. The longer fibers form the warp and the shorter the woof, which are passed in and out by means of a little instrument with an eye like a needle. Until within a few years this concluded the whole process—the "foundations," as they are called, were complete, and nothing more was done except that a few hats and caps were made of them. These were of the simplest description, and anything but becoming; moreover, they were glued together, thus making them unpleasant to wear in hot or wet weather; accordingly they brought but 30 or 60 cents per dozen, and were worn by the very lowest classes.

Within the last few years, however, owing partly to the interest taken by the government in the manufacture, a great change for the better has taken place. At present Ehrenberg sends out not only the raw material, but ready-made goods—fashionable hats of all kinds, and a variety of fancy articles skillfully concocted out of the wood fabric; ladies' hats of every description and of the latest fashion, such as no one need be ashamed to wear, are made entirely of wood, and sold at astonishingly low prices. Men's hats are to be had of all shapes, from the Panama hat—not a whit inferior to that bought in Paris—to the common hats exported in large quantities to China, and the linings or foundations of which give stiffness to the fez of the Turkish soldier. The export trade embraces all Europe, from Spain to Russia, extends beyond the Caucasus to India and China, and maintains active relations with North and South America as well as Australia. The manufacturers are in direct communication with the four quarters of the world, and their goods are being introduced into Africa by French and English traders.

Fungi in Mines.

According to the *Virginia City Enterprise*, many of the deserted Ophir and Mexican mines have been taken possession of by great varieties of the fungus tribe, which grow there more luxuriantly than mushrooms do in the caves underneath Paris. The fungi are chiefly found on the old timbers in the warm, moist, lower levels. Some of them, says the *Enterprise*, are several feet in hight, and, being snow white, resemble sheeted ghosts. In places are what, at a little distance, appear to be white owls, and there are representations of goats with long beards, all as white as though carved in the purest marble. The rank fungus growth has almost closed some of the drifts. The fungi are of nearly every imaginable variety. Some kinds hang down from the timbers like great bunches of snow-white hair; others are great pulpy masses. These last generally rise from the rock forming the floor of the drifts, and seem to have grown from something dropped or spilled on the ground at the time work was in progress in these mines years ago. These growths have in several places raised from the ground stones weighing from 10 to 50 and even 100 pounds. In the higher levels, where the air is comparatively dry, the fungi are less massive in structure, but are much firmer in texture. Some resemble rams' horns, as they grow in a spiral shape, while others, four or five feet in length and about the thickness of a broom handle, hang from the cap timbers. One kind, after sending out a stem of the thickness of a pencil to the length of a foot or two, appears to blossom—at least produces at the end a bulbous mass that has some resemblance to a flower. In all the infinite variety of these underground fungi, it is strange that not one was seen at all like those growing upon the surface in the light of day. No toadstools or mushrooms were found.

The Paris Electrical Exhibition.

The electrical exhibition now in progress in Paris, is without doubt the most complete and important representation of the application of electricity to the arts that has ever been made. Thus far, however, the accounts that have come to us respecting the display have been very meager. Edison's exhibit is said to be the largest and most imposing of any in the exhibition; but his system of domestic lighting does not seem to have met with unqualified approval. The electric railway of Siemens & Halske is specially worthy of notice, and attracts much attention.

Speaking of the French exhibits, one of our exchanges makes the following rather uncomplimentary comments, which may or may not be justified by the facts: "The French applications of electricity are designed more for the astonishment of the beholder than for practical use. Most of these are grouped together in a house where all sorts of domestic work is done by electricity. All the rooms are lighted by electric lamps, some of which are lighted by the opening of the door to the apartment. The kitchen range is heated by electric currents passed through water; incandescent platinum wires cook electric waffles; and electrically heated plates serve for braziers and chafing dishes. The dishes are carried to the dining-room by electric dumb-waiters; various buttons, when pressed, call to one's side errand boys, doctors, firemen or servants, or put one in communication with friends by telephone. The parlor has an electric fire-place and clocks, a piano to be played from a distance by electricity, and a melograph to make an electric record of improvisations. The billiard room has an electric indicator for marking the game, and the nursery is filled with electrical toys to amuse the children. The bedroom has revolving electrical hair-brushes, and is also illuminated and heated by subjugated lightning. There is also a small theater, fitted up with electrical apparatus for lighting, scene-shifting, etc. Most of the things here mentioned are mere costly toys, of little practical value; but they show that electricity is an agent capable of doing almost anything when properly harnessed."

To Harden Finishing Varnish.

A newly varnished carriage is liable to spot. To prevent this, wash the carriage several times in cold water, applied with a sponge instead of a hose; this will help to harden the surface, and prevent it, to some extent, from being injured by the mud or water getting splashed on the job. Never let mud dry on the surface, and then wash off expecting to see no spots on the varnish. You will certainly be disappointed, and the only way to remedy the evil will be to have it revarnished. Soft water is better than hard water for the washing of carriages, as the lime which is in the hard water is very liable to injure the varnish.

Scientific.

ALLOYS OF ALUMINUM.—While it is true that on account of the cost of its production, the metal aluminum has attained but a limited application in the arts, its alloys with other metals are worthy of the special consideration of technologists, and there is a strong probability that a wide field of utility may be open for them in the future.

Dr. Biedermann, a well-known authority in metallurgy, in referring to this subject, remarks: "Although there is no mistaking the fact that the high expectations with which the appearance of aluminum filled the public mind have not been met, yet the aluminum industry has a safe guarantee of its existence in the use of the metal for aluminum alloys, which are capable of the most extensive use on account of their excellent qualities."

Thus far, however, the only alloys of aluminum that have acquired importance in the arts, are the so-called aluminum bronzes. According to Morin, very homogeneous alloys are obtained with copper and 5, 7½ and 10 per cent of aluminum. The alloys with 5 and 10 per cent of aluminum are characterized by having a golden color, while that with 7½ per cent has a greenish tint. Even so small an addition as 1 per cent of aluminum to copper, according to another authority, considerably increases its ductility and fusibility, and imparts to it the property of completely filling the mold, making a dense casting, free from air bubbles. At the same time the copper becomes more resistant to chemical reagents, increases in hardness without losing in malleability, and unites in itself the most valuable qualities of bronze and brass. A copper alloy with 2 per cent of aluminum is said to be used in the studio of Christofle, in Paris, for works of art. It is claimed to work well under the chisel and graver.

According to Rudolph Wagner, the true aluminum bronzes were first made by John Percy in 1856. As above remarked, they are alloys containing from 90 to 95 per cent of copper, with from 10 to 5 per cent of aluminum. The direct mixture, by first fusion, of 10 parts of aluminum and 90 of copper, gives a brittle alloy, which, however, increases in strength and malleability after several successive fusions. At each operation, a little aluminum is lost. After the compound has been melted three or four times, however, the proportion of aluminum does not appear to change, and the alloy may be afterwards repeatedly re-melted without alteration. These fusions are effected in crucibles. The aluminum bronze is homogeneous, and possesses sufficient expansion to fill the finest parts of the mold. It affords sharp castings that can be worked more readily than steel. Aluminum bronze may be forged at a dull-red heat, and hammered until cooled off without presenting any flaws or cracks. Like copper, it is rendered milder and more ductile by being

plunged into cold water when hot. The bronze polishes beautifully, and possesses great strength. Anderson's experiments give it an average tensile strength of 75,618½ pounds per square inch. Its resistance to compression is feeble. From the trials of Colonel Strange, on the relative rigidity of brass, ordinary and aluminum bronze, it is shown that the last named is 40 times as rigid as brass, and 3 times as rigid as ordinary bronze.

Other experiments have shown that aluminum bronze, under the cutting tool, produces long and resisting chips; that it does not clog the file; that it engraves nicely, etc.; that it is easily rolled into sheets; that in the melted state it expands very much, and is capable of producing the sharpest castings; but that as it cools off rapidly it is subject to shrinkage, and hence to cracks when the article is bulky, requiring, on these accounts, numerous runners and a heavy feeding head; and lastly, that, though not entirely unoxidizable, it is not so readily tarnished by contact with the air as polished brass, iron, steel, etc.

Dr. Biedermann speaks very highly of this metal. "In the construction of physical, geodic and astronomical instruments," he says, "it is far preferable to all other metals. In jewelry and other articles of art and luxury, it is employed in considerable quantities. Many kinds of household utensils are made of it, and it is also adapted for journal bearings; gun and pistol barrels, as well as rifled cannon have been made of it, and have done excellent service." It has been highly recommended for type metal, types made of it lasting, it is affirmed, fully fifty times as long as those made of common type metal. It has been employed for making the beds of perforating machines for perforating postage stamps, and for the main springs of watches. For this last use it is said to be specially serviceable, as it is very hard and elastic, not magnetic, and much less liable to rust than steel. Notwithstanding the great and acknowledged value of the aluminum bronzes, however, their considerable cost, varying from $3 to $10 per pound, according to the percentage of aluminum they contain, has operated very materially in restricting their uses.

Aluminum alloys with several other metals have been made, but these have been mainly experiments, and none of them, with the exception of the bronzes above referred to, have acquired a permanent value in the arts. The most notable of these are the alloys with silver and iron. They are, however, not specially important, and may be passed over with the brief remark that an alloy of aluminum with 4 per cent of silver has been found quite useful for the beams of fine balances, for which the extreme lightness and resistance to atmospheric influences which the alloy possesses, adapt it very well. It may be added in conclusion, that the claim has been put forth that the addition of a small percentage of aluminum to steel materially improves its qualities. This claim, however, has not yet been fully substantiated.

Philosophy of a Lump of Coal.—We all know that our streets and homes are illuminated by gas, that this gas is obtained from coal, and that coke and gas tar come from the gas works; but here ends, generally speaking, our knowledge of the remarkable product of nature called coal, if we simply include its employment in our fire-stoves. But there is a great deal more to be said about coal, after the gas works have done with it, than most people are aware of. When coal is placed in an iron retort, and heat applied, after awhile its gaseous and volatile constituents become liberated, and coke alone remains behind. Now, if we connect a tube to dip into a vessel of water, we shall find that bubbles of gas escape from the tube, while the water has become impregnated with ammonia; and after awhile a dark mass appears at the bottom of the vessel. This latter substance is called "coal tar." Now, if we place a quantity of coal tar in a retort furnished with a tube, terminating in a "worm" surrounded by cold water, as in distilling, and heat the retort gradually, we soon find that a fluid substance, having a powerful odor, escapes through the worm pipe, which we collect in a receiver. This liquid is coal tar naphtha, and is composed of many different substances, all more or less inflammable, the lightest and most volatile product being benzole. If the coal tar naphtha be now placed in a retort fitted with a receiver, and heat applied below 200° Fah.—that is, below the boiling point of water—a light spirit distils over, which is termed benzole. When fuming nitric acid is added to benzole, violent chemical action takes place, and the resulting compound is called nitro-benzole. If water be now added, the nitro-benzole deposits at the bottom of the vessel in the form of a thick oily mass, somewhat like the yolk of an egg. To convert the nitro-benzole into aniline, we proceed as follows: The nitro-benzole is placed in a glass or stoneware retort, and iron filings and acetic acid added in the proportion of two parts of the former to one of the latter to an equal volume of the nitro-benzole. Effervescence takes place, and aniline, a colorless fluid, distils over into the receiver. When the effervescence ceases, gentle heat is applied to assist the operation. Having thus obtained our aniline, we next proceed to treat it with various chemical substances, when remarkable—indeed marvelous—changes are effected, as we shall presently see. When bichloride of mercury, bichloride of tin, and certain other chemical salts are mixed with aniline, a compound is formed which has been termed rosaniline. When dry, it appears in the form of beautiful green crystals, having a somewhat metallic luster, not unlike the wings of the common May bug, a beetle frequently seen on our rose bushes. When these green crystals are placed in hot water, or in spirit of wine, a gorgeous red-colored solution is the result. Now there is nothing whatever in the process by which they were formed to indicate the marvelous *finale* to this most strange series of chemical reactions—the production of a brilliant red dye possessing such wonderful intensity and beauty! However charming the result, we must not forget its humble origin—a lump of coal! By treating aniline with certain other chemical substances, magenta, mauve, fuchsine, roseine, eosine, and many shades of blue, green and other colors and tints are produced, all remarkable for their beauty and vividness of hue.

Disinfectants.—The following article, which we think must misrepresent an eminent chemist, is now going the rounds of the technical journals, and is deserving of comment as it contains a good deal of nonsense, and omits as much that is important, viz.:

"Prof. Beilstein, who has recently studied the various substances used for disinfection, arrives, in a communication made to the St. Petersburg Technical Society, at the following conclusions: Sulphuric acid would be the best disinfectant if it did not destroy the sides of the tanks; the use of lime and of salts of lime ought to be completely renounced, as they but temporarily destroy bacteria, and under some circumstances may contribute to their development; nor does sulphate of iron, even in a solution of 15 per cent, ultimately destroy bacteria, as they revive when put into a convenient medium. Therefore, Prof. Beilstein recommends sulphate of aluminum, which is used in paper and printed cotton manufactures. The best means for providing it is to make a mixture of red clay with 4 per cent of sulphuric acid, and to add to this mixture some carbolic acid for destroying the smell of the matter which is to be disinfected."

Why Prof. Beilstein recommends sulphate of aluminum does not appear. That substance, as well as other salts of aluminum, have been repeatedly recommended and employed for disinfecting purposes, and have been very generally discarded as being ineffective. Salts of aluminum are decidedly inferior to either chloride of lime, chloride of zinc, or carbolic acid in disinfecting power, whether measured by their power of destroying unpleasant odors or by the more searching test of arresting the vitality of bacteria and other low forms of life. These statements are not mere assertions, but are based on the facts of repeated and very thorough tests of the comparative virtue of this class of substances. Why lime salts should be tabooed, when their condemnation would deprive us of the chloride of lime, one of the cheapest and best of disinfectants, passes our comprehension; and why neither this substance, nor chloride of zinc, nor carbolic acid should have been mentioned in the above item, is equally incomprehensible.

Artificial Products.—Chemists, says the *British Mail*, are steadily revolutionizing old processes and ruining old industries by their synthetic methods of making the counterfeits of natural products. The madder industry of France was the first to feel the power of modern chemistry, and now madder is a comparatively useless crop. The coloring principle which was so valuable to the dyer was analyzed by the chemist, and separated into its elements. But the chemist went farther; he found a comparatively waste substance which, by a little manipulation, would yield just the same elements as the madder root, and in just the same proportions. Consequently it must, except under special circumstances, be identical in constitution with the natural product. The indigo planters of India are threatened with a similar extinction, for the coloring matter known as indigo has been synthetically prepared in the chemist's laboratory, and only awaits a cheaper raw material than the indigo plant to gradually bring about the decline of one of the most profitable crops of India. Citric acid is another notable instance of the triumph of synthetical chemistry; and latterly a process of preparing vanillin, the essential oil of vanilla, has been patented in this country. By and by chemistry will make for us the most delicate perfumes and the most costly flavors out of the waste substances of other industries.

Production of Magnesia.—The cheap production of magnesia on a large scale has become a subject of much technical importance since this material has been found to be quite important in the manufacture of cements, artificial stones, fire-proof bricks, and other refractory materials. The immense quantities of chloride of magnesia found in the celebrated salt deposits at Stassfurt, in Prussia, have caused many efforts to be made to produce magnesia from this source. The latest proposal of this kind is that of M. Closson, of Paris, who treats the chloride of magnesium lyes with burnt dolomite, and has apparently succeeded in producing a very pure magnesia. Magnesia bricks made from material produced by this process, have, according to the *Chemical News*, withstood even the heat of the oxy-hydrogen flame. The process of M. Closson, according to published accounts, has been introduced on a working scale at Leopoldshall.

Diseases to which Coal Miners are Especially Liable.—The Belgian Academy of Sciences has received a report on the researches made by M. Fabre, regarding the diseases to which coal miners are especially liable. He finds that, as coal absorbs rapidly up to 100 hundred times its own volume of oxygen, the air which the miners have to breathe is deprived of oxygen to a hurtful degree. The atmosphere of a mine is also further vitiated by the gaseous carbon compounds given off by the slow combustion of the coal. M. Fabre concludes that a supply of air is more essential than that of light, and even the best ventilated mines require better ventilation.

Artificial Indigo.—It may interest our readers to know that artificial indigo is now a commercial product, though the cost of its production on a large scale in competition with the natural dyestuff has thus far not been made possible, by reason of its greater cost. It is, nevertheless, an interesting fact to notice that this product has been artificially produced; and it is safe to predict that the removal of economic difficulties that now exist in the ways of its cheap manufacture, is only a question of time, and that the manufacture of the natural dyestuff will speedily have to go the way of the madder culture.

Fish Culture.

The beneficial effects of the work that has been going on for some years through the efforts of the United States Fisheries Commission, aided by the Fish Commissioners appointed by a number of the States, of stocking the almost depleted rivers and inland waters of the country with valuable food fishes, cannot well be overestimated. The magnitude of the operations of the United States Commission of Fisheries is known to comparatively few, and the results of its work are not immediately apparent; but if the work it is engaged in is continued for a few years longer on the same liberal scale, and with the same scientific skill and success as have attended it since its organization, the inland waters of our country will probably be more abundantly supplied with finny inhabitants than they ever were before the work of depletion began.

The habits and mode of life of the more valuable food fishes have been so thoroughly studied, and the difficulties of their propagation so satisfactorily mastered, that the work of stocking the rivers, lakes and streams with the choicest varieties is now conducted with certainty and dispatch, and on a scale which will find them in swarming myriads when a few years have elapsed, if the protective laws that have been wisely enacted in many of the States are reasonably well enforced.

The food fishes that the Fish Commissioners have specially tried to introduce, are the shad, black bass, salmon, and speckled trout. A few other species have been experimented with, but those named are the most important ones. Of these, the shad and black bass appear to have thriven best, and their numbers are known to have very greatly increased. On the Pacific coast especially the experiments for the introduction of the shad have been very satisfactory. A few years ago this splendid food fish was entirely unknown in the rivers of the Pacific slope; but since they were stocked by the Fish Commission, their numbers have so rapidly increased, that to-day the shad is a common article of food in the States of California and Oregon.

The attention of the United States Fisheries Commission has lately been directed to the introduction of the German carp, which is very abundant in Germany, and highly esteemed there as an article of food. It thrives well in almost any situation, and especially in sluggish streams and ponds where other species of fish would die. The carp is easily raised, is an omnivorous feeder, taking kindly to the vegetable refuse of the kitchen, and increases so rapidly in size that it will prove one of the most desirable additions to our list of food fishes. Withal, its flesh is delicate and palatable. It is said of the carp, that it holds the same place among the food fishes that the domestic fowl holds among birds, so valuable is it esteemed in the countries where it is domesticated.

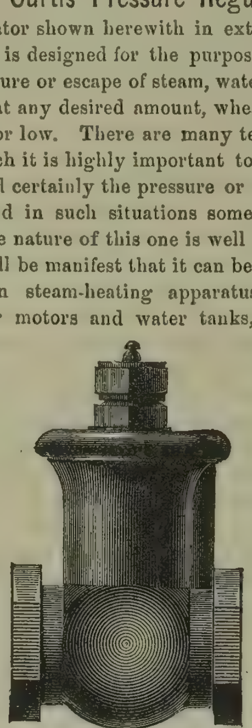
It is highly important, in order that the efforts of the Fish Commission shall be successful, that their work should receive the protection of reasonable and intelligent restrictive laws in the several States, and that these laws should be faithfully enforced. The failure to enact and enforce such laws is the most serious hindrance to the success of the Fish Commission's work. The experience of the past few years has shown that the stocking of our inland waters with food fish by artificial propagation has been attended with very gratifying success, and the prosecution of the work with the same intelligent zeal that has characterized the work of the Fish Commission from its organization, will, we trust, ultimately meet with complete success.

The immense addition to our food supply which we are promised by this benificent work, is a subject of more than ordinary importance, since every household is more or less directly interested in it.

OIL FROM AMERICAN GRAPE VINES.—A Frenchman has discovered that an oil can be distilled from American grape vines which will not congeal above 8° Fah., while other oils congeal at 27½°. He recommends this oil for watch-making and similar uses.

The Curtis Pressure Regulator.

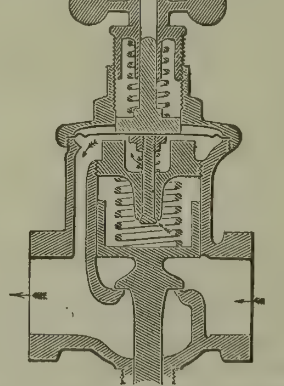
The regulator shown herewith in exterior and sectional views, is designed for the purpose of maintaining the pressure or escape of steam, water, gas or compressed air, at any desired amount, whether the pressure be high or low. There are many technical operations in which it is highly important to control automatically and certainly the pressure or escape of gas or liquids, and in such situations some device or apparatus of the nature of this one is well nigh indispensable. It will be manifest that it can be used to great advantage on steam-heating apparatus, dryers, air pumps, water motors and water tanks, as well as in



The Curtis Pressure Regulator—Exterior View.

sugar houses, bleacheries, dye houses, water works, and the like. It occupies the same space as a globe valve for the same size pipe, has no glands or packing, is made entirely of metal, and is very simple and readily understood. The construction and action of the apparatus will be understood from the following description.

The sectional view shows a main valve, operated by a loose-fitting piston; a secondary valve in the top of the chamber, over the piston; a metallic diaphragm,



The Curtis Pressure Regulator—Sectional View.

performing the double office of operating the secondary valve and making a steam joint to the cap which contains it; and a side passage, connecting the chamber under the diaphragm with the outlet. When the spring over the diaphragm is compressed, the diaphragm gives way, and thus opens the secondary valve upon which it rests. Steam from the boiler being let on, raises the piston, and therewith the main valve, to its full capacity. The main valve remains open until the back pressure communicated from the outlet through the side passage is sufficient to raise the diaphragm, and thus close the secondary valve, when the steam, escaping around or through the loose-fitting piston, fills in the space on top of said piston and forces it towards its seat, thus uniformly maintaining the pressure at which it is set. To make sure that enough steam passes the piston to produce the required pressure on top of it, an adjustable set-screw is placed in the piston, making a very minute opening through the piston; this must always be kept open. The caution is also given to thoroughly clean the pipes by blowing steam through them, to prevent chips or scale from getting in the seat.

This pressure regulator is manufactured by the Curtis Regulator Co., at 59 Beverly street, Boston, or can be obtained of A. Aller's Agency, 109 Liberty street, New York.

The Hudson River Tunnel.

The progress of the work on the Hudson River tunnel continues to be satisfactory. Work has lately been commenced on the New York side of the river. A huge caisson has been finished, with the exception of the air-lock, which will soon be put in place, when the structure will be sunk to the proper depth. On the Jersey side, to which the tunneling work has been confined, four new air-locks, located about 500 feet from the caisson, were finished several weeks ago, and put under air pressure. When this was done, the air pressure was taken off from the 500 feet of finished tunnel behind them. Contrary to what we have been led to expect, from the accounts that have appeared of the strength and stability of the structure, a number of leaks were developed as the air pressure was removed, through one of which, in the north bore, the water is reported to have entered in such volume that it could only be stopped after much hard work. This leak is directly under the bulkhead of the river. This is explained by Mr. Charles Haskin, who says that the bulkhead is formed of a crib-work of timbers, with very little earth, through which the water circulates. Before the new air-locks were put in, the heavy pressure of air which was kept in the tunnel was somewhat greater than the pressure on the tunnel from the outside. This made a strain on the brick-work, and cracked it, and as soon as the air was let off the water came through.

This explanation must strike the engineering mind as being highly unsatisfactory. This portion of the tunnel, it should be noticed, is reported to be finished—that is, the iron plates and masonry-work are all in position, and yet its strength and stability are so inferior that on the withdrawal of the trifling excess of air pressure within (about 10 or 15 pounds to the square inch), it shows the effects of strain and weakness by allowing the water to pour in. It would be interesting to know what factor of safety Mr. Haskin has allowed for his structure, or whether he proposes to support it by air pressure all the time. Certainly there is something wrong with a tunnel that develops dangerous leaks on the withdrawal of so trifling an interior support as a few pounds of air pressure.

Newspaper accounts that have lately come to our notice, contain also a reference to a break in the heading of the south tunnel. This is apparently a new complication, as the break above named is represented to be in the finished portion of the tunnel (presumably the north bore, which has progressed much farther than the other), behind the new air-locks. The statement referring to the last named complication is as follows: "The work of repairing the break in the heading of the south bore is going on slowly, on account of the softness of the silt, which is giving much trouble, and only a few of the bent and broken plates have been removed. The position of the break can easily be seen from the bulkhead of the river, by the air which escapes making the water foam."

If these troubles are to continue, and it is impossible to predict what new contingencies and accidents may occur as the work progresses, Mr. Haskin's novel plan of driving a tunnel laterally through yielding materials without the aid of shields, may turn out to be far more expensive than the old standard methods that he has endeavored to improve upon. The plan of pushing a small pilot tunnel in advance of the work at the headings, is a decided step in the direction of throwing the greatly needed safeguards about the workmen, and is to be commended. But the evidences of the dangerous weakness of the portion of the tunnel already finished, which we notice in what has preceded, are very unsatisfactory and disquieting.

SILVER IS THE MOST PERFECT REFLECTING METAL, absorbing less than 3 per cent of the rays of light.

Penfield Block Co.'s Pulley Blocks, etc.

We were obliged, on account of overpressure of matter, much to our regret, to omit reference in our October number to the works of the Penfield Block Co., of Lockport, N. Y., whose card appeared in the advertising pages of that issue. This company are among the most prominent makers of pulley blocks in the country, and a few lines on the subject of the manufacture of these indispensable adjuncts of hoisting gear will doubtless interest our readers.

No line, perhaps, has preserved its originality from year to year more than this, most manufacturers having been content to make blocks as they found them, doubtless thinking as long as there was no complaint there was no necessity for improvement. Not so with the Penfield Block Co., however. Early in their career the necessity for improvements—specialties, in fact—was conceived, and resulted in the introduction of several which have gone far toward revolutionizing the block business, and been the means of building up their trade to its present unsurpassed proportions. Among them is their Improved Iron Sheave, which, for inland trade and dry climates, fills the bill and obviates the trouble experienced by the cracking of lignum vitæ sheaves. Their Wrought-Iron Blocks also have been a boon to contractors, railroad men, and all having heavy work to perform, as have been their All-Steel Roller Bushings; and lastly, their Self-Lubricating Phosphor-Bronze Bushing. They hold a patent for rounding out the sides of their Wrought-Iron Blocks to protect the rope; and their Self-Lubricating Bushing is also fully covered. No one should fail to see a sample.

In addition to their line of blocks, etc., they manufacture a full line of Warehouse Trucks and Four-Wheel Wagons; also Moore's hand hoist, with which one man can hoist 600 pounds with ease, and by means of the brake can suspend the load at any desired point.

The company have recently largely extended their works, and are now in position to fill orders promptly. Henry B. Newhall, of 105 Chambers street, is their New York agent, with whom a stock of regular goods can be found, and either he or the factory will cheerfully answer any inquiries, and send catalogue on application.

A New Method of Inlaying Wood.

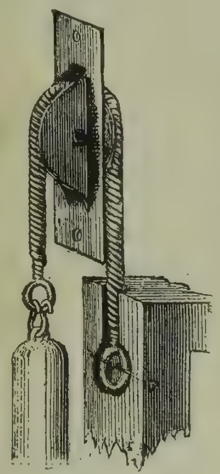
A new method of inlaying wood has been contrived by a furniture manufacturing house in England. The process is as follows: A veneer of the same wood as that of which the design to be inlaid consists—say sycamore—is glued entirely over the surface of any hard wood, such as American walnut, and allowed to dry thoroughly. The design is then cut out of a zinc plate about one-20th of an inch in thickness, and placed upon the veneer. The whole is now subjected to the action of steam, and made to travel between two powerful cast-iron rollers of 8 inches in diameter by 2 feet long, two above and two below, which may be brought within any distance of each other by screws. The enormous pressure to which the zinc plate is subjected forces it completely into the veneer, and the veneer into the solid wood beneath it, while the zinc curls up out of the matrix it has thus formed and comes away easily. All that now remains to be done is to plane down the veneer left untouched by the zinc, until a thin shaving is taken off the portion forced in the walnut, when the surface, being perfectly smooth, the operation will be completed. It might be supposed that the result of this forcible compression of the two woods would leave a ragged edge, but this is not the case, the joint being so singularly perfect as to be unappreciable to the touch; indeed, the inlaid wood fits more accurately than by the process of fitting, matching, and filling up with glue, as is practiced in the ordinary mode of inlaying.

Hollow Steel Shafting is now coming into extensive use. This shafting is produced by casting the metal around a core of lime, the ingot being finally rolled into shafting, the lime going out with it, diminishing in diameter in the same proportion as the metal, even when the total diameter is reduced as low as ½ inch. A Manchester (England) manufacturer is taking the matter up, and samples have recently been shown on the Exchange among members of the iron trade, and created considerable sensation.

The Climax Sash Cord.

The sash cord shown in the accompanying engraving is made of steel wire coiled into a close spiral, and has the important merits of extreme durability and noiseless action. In comparison with chain, wire rope, and other materials employed for this purpose, the new sash cord has, in addition to the foregoing advantages, also that of being cheaper.

In attaching the cord to its place, the coil as it is shipped is cut to proper lengths, and a screw-eye, similar to those commonly sold in the market, is screwed into one end of the cord and affords a means of secure attachment to the sash. This is sufficient, though the same may be fastened in by a screw through the eye into the sash or by a pin passed through the sash in front of the eye, to prevent the eye from turning round. A similar screw-eye is provided at the other end of the cord, to which the weight is attached by hooks. The engraving accompanying this article represents the Climax sash cord in place, showing the method of attaching it to the sash and the weight, referred to in the above. In addition to the advantages above recited, the makers likewise call attention to the fact that the elasticity possessed by this cord is a very desirable feature in connection with its use with heavy sash and correspondingly heavy weights. Its handsome appearance, likewise, will no doubt commend it to the favor of builders.



The Climax Sash Cord.

The makers manufacture several sizes of these cords, adapted to be used with sash weighing from 25 pounds up to 400 pounds. They have likewise adapted a cord of the same general character to be used with curtains. We are also advised that they have extended the application of their cord to the transmission of power, having, as we are informed, produced driving belts which have answered the purpose of transmitting power in a very satisfactory manner up to 36 horse-power.

The sole manufacturers of these novelties are the Perpetual Tension Propelling Belt Co., of 328 and 330 Seventh avenue, New York city.

Steam Boiler Notes.

The boiler of J. J. Cornish's saw mill, near Richmondsville, ten miles northwest of Port Sanilac, Mich., exploded at 4 o'clock P.M., October 6th, instantly killing Fred. H. Diehm, who was acting as engineer. The top piece of the south end blew out, striking Diehm, who was standing directly in front, knocking him about ten feet, breaking his neck, bruising his face, and scalding his body above the waist. The owner of this mill made a statement which runs thus: "About half an hour before the disaster, I went to see to the boiler and engine, and found them working all right. I told Diehm he must put on the injector about ten minutes, but do not know whether he did or not. Just before the explosion he stopped to oil up, and I did some oiling around the saw. Diehm said to me, 'Are you ready?' I said, 'Just about.' He said, 'Hurry up.' I said, 'All right; go ahead,' and looked up. I put my hand on the saw lever, ready for work, and saw him go to the globe valve to turn on the steam. The steam gauge was facing me, and, as I looked up, I glanced at the gauge and saw that it registered 65 pounds only. Before the engine had started, I saw dust and steam and flying bricks, and then heard a deafening report. I know at once that the boiler had exploded, and ran to where Diehm stood; did not find him, and looked around, but did not see him or hear him. I thought he was killed. Ten or fifteen feet away to the south, and directly in front of the boiler, the body lay on its face. I never saw him move. I was hit with pieces of brick, but not injured at all. The boiler was stationary, set with brick, and was bought second-hand of Bruno Gunt last spring. When bought it tested 200 pounds, which it stood all right." The mill had been burned and rebuilt some time previous to the explosion, and when ready to start the boiler was tested again the same as at first, and stood the test all right, except around the dome, where a number of pin-holes appeared. As only 60 or 70 pounds of steam were needed, it was thought to be safe. The boiler sets north and south, fronting south. The explosion took the top half of the front out, lifted it clean off the arch, and threw it about twenty rods up a hill. It struck on end and turned completely over.

The boiler in Thomas Grady's shoddy dye works at Clifton Hights, Delaware county, Pa., exploded October 10th, instantly killing the engineer, Robert McClure, and wounding several other persons. James Maguire had his collar bone broken, and was sent to the Pennsylvania Hospital. The other wounded were taken to their homes. The mill was partially wrecked by the violence of the explosion, and, taking fire from the coals scattered from the furnace, was totally destroyed.

The Hamilton (Ont.) *Times* has the following in relation to the threshing-machine boiler that exploded September 23d, killing Andrew Lloyd and wounding a young woman and two men besides Lloyd: "Mr. Robb, Chief Engineer of the Canadian Steam Users' Insurance Association, who was commissioned by the Ontario government to examine the remains of the boiler which burst with fatal results at Thurlow, has completed his inspection and prepared his report. After making close examination, he reports that the boiler was evidently well kept—that it was clean, and that there are no signs that the water was allowed to run low. This is a strong point in favor of the engineer. 'The boiler burst,' he says, 'from inherent weakness, being made of poor material.' It was not provided with a first class safety valve, and the valve it has should in justice be called a danger valve."

The boiler at Major's flour mill, Colinville, Ontario, exploded at an early hour on the morning of October 11, wrecking the engine house and saw mill, and seriously scalding William and Headley Major, sons of the proprietor, and William Bickell, miller. About 6 A.M. a fire was started under the boilers, one of which was a tubular and the other a flue, and it was left unguarded while the hands were at breakfast. After breakfast the three men named above went into the engine house, and were standing close to the flue boiler when the tubular one exploded. The cause is not definitely known. The steam guage, just previous to the explosion, registered 56 pounds. No boiler of ordinary strength, that is, retaining a proper margin over the working pressure, has ever been *known* to explode at 56 pounds per square inch; but a great many have done so at pressures not greater than that, which showed defects of such extent as to excite surprise in the minds of observers that the boiler had sustained even so much as its common load. On the other hand steam guages do not always tell the truth; they are not only often from 10 to 50 pounds slow, but they are often cut off entirely by the obstruction of mud or sediment in the pipe that communicates with the boiler. Again, they sometimes stop at a regular point above which the pointer cannot go from obstructions in the quadrant gear. In short no reliance can be placed on a boiler that is not sound and has not a perfectly reliable and well kept safety valve.

Latest Market Report of Building Materials.

NEW YORK PRICES.

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LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	21 00 a 22 50
Pine, common box	18 00 a 20 00
Pine, common box, ⅝	16 00 a 18 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	30 a 32
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	23 a 25
Pine, strip boards, merchantable	17 a 19
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	25 a 27
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch,	43 a — 44
Spruce wall strips	14 a — 16
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	48 00 a 52 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	110 00 a 120 00
Black walnut, ⅝-inch	80 00 a 90 00
Black walnut, selected and seasoned	150 00 a 175 00
Black walnut counters, per ft	20 a 25
Cherry, wide, per M	90 00 a 110 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	35 00 a 40 00
White wood, ⅝ panels	45 00 a 50 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 00 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale per M.	4 75	a 5 00
Up Rivers	7 75	a 8 25
Jersey	7 50	a 8 00
Haverstraw Bay	8 87½	a 9 00
" " choice	8 50	a 8 75
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown per M.	11 00 a 12 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	30 00 a — —
Trenton	28 00 a 30 00
Baltimore	40 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	26 00 a 26 50
" Glengarnock	25 00 a — —
" Eglinton	23 00 a 23 50
" American, No. 1	25 00 a 26 00
" American, No. 2	22 50 a 23 00
" American, forge	21 00 a 22 00

LEAD—PER 100 POUNDS.

German	— — a — —
English, common	— — a — —
Spanish	5 75 a — —
Foreign, refined	— — a — —
Bar	6 50 a — —
Sheet	7 50 a — —
Pipe	— — a — —
Domestic	4 63 a — —

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 30 a 3 40
8d and 9d, common	3 65 a — —
6d and 7d, common	3 90 a — —
4d and 5d, common	4 15 a — —
3d and 4d, light	4 95 a — —
3d, fine	5 65 a — —
2d, fine	5 65 a — —
Cut spikes, all sizes	3 65 a — —
Clinch nails, 1½ to 1¾ inch	5 65 a — —
do. 2 to 2¼ inch	5 40 a — —
do. 2½ to 2¾ inch	5 15 a — —
do. 3 inch and longer	4 90 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

I. C. charcoal, 10x14, per box	6 25 a 6 50
I. C. coke, 10x14	5 25 a 6 00
I. X. charcoal, 10x14	8 00 a 8 25
I. C. charcoal, 14x20	6 25 a 6 50
I. X. charcoal, 14x20	8 00 a 8 25
I. C. coke, 14x20	5 25 a 6 00
I. C. coke, terne, 14x20	5 00 a 5 25
I. C. charcoal, terne, 14x20	5 25 a 5 50

SOLDERS.

Half and half	— 14½ a — —
Exra	— 13½ a — 13¾
No. 1	— 12½ a — 12¾

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 7¼ a — 7½
Sheet, (open)	— 7¾ a — 8

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No. 1, buff, in rough, pr. cub. ft.	1 00 a - —
do do No. 1, blue, in rough	- 85 a - 95
Bedford Stone	1 25 a - —
Berlin Freestone, in rough	- 75 a 1 00
Berea Freestone, in rough	- 75 a 1 00
Brown Stone, Portland, Conn	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a - —
do Mary Point Brown Stone	1 00 a - —
do do Olive Stone	1 00 a - —
Brown Stone, Belleville, N. J	1 00 a 1 35
Granite, rough	- 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a - —

PAINTS.

Carmine, American, per lb	5 00 a 5 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6¾ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil	— 9 a — 10
Litharge	— 6¾ a — 7
Ochre, Fr., dry, per 100 lbs	1 50 a — —
Ochre, ground, in oil, per lb	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
Orange Mineral, English	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
Vermilion, Chinese, per lb	— 85 a — 90
Vermilion, Trieste	— 70 a — 75
Vermilion, quicksilver, bags	— 50 a — 52½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
Zinc, white French, dry, (Red Seal,)	— 7 a — 8
Zinc, white French, in oil	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 60 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 10 a 1 25

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — —
Goat, " "	— 21 a — —

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	1 00 a — —
" finishing	1 15 a 1 25
Rockland, common, cargo rate	1 10 a — —
" finishing	1 25 a — —
Ground	1 00 a 1 10

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 28
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

CEDAR.

Cuba, per superficial foot	— 7 a — 11½
Mexican, small	— 7 a — 8
Mexican, large	— 9 a — 11½
Florida	— 40 a — 75

GENERAL REVIEW OF THE MARKETS.—In the lumber market during the past month business has been rather slow in a wholesale way, and without features of special interest. Really good and attractive offerings have received comparatively quick attention, and have commanded full former rates—in short, values generally have been well sustained, but the volume of trade has not grown to any great extent, and buyers are somewhat fastidious in the selection of stock.

In the brick market demand has been of about the same proportions as noted in our last report; certainly it has not increased, and all purchases have been kept down to the closest limit of immediate necessities, buyers evidently prefering to negotiate several times over rather than take more stock than could at once be run into consumption. Supply, in fact, balances the outlet, with possibly a little to spare. Prices have favored the buyer, and while there has been an effort to "bull," the attempt was ill-timed, and failed of support by reason of the unexpectedly light consumption, caused by the condition of the weather.

In the lath market there has been a very liberal amount of stock coming to hand since our last report, and fair offerings are still making, but notwithstanding this prices have been well maintained up to the latest date of information for our report. Consumption has been good; dealers have been in almost constant want of supplies, and whenever demand temporarily slacked up, or the arrivals happened to mass into excessive proportions, it was only necessary to notify Jersey customers, and they took all the surplus at full rates.

In the lime market holders have held rates at full former figures, and have found demand for all stock coming to hand. The movement of buyers, however, has not been of an unusually anxious character, and it is claimed that considerable quantities of stock are on the way, with receivers as yet unprepared to advance the line of cost.

In the hardware market some irregularity has been shown in the demand since our last report, and the volume of business does not appear to have been quite so full in the aggregate as for the preceding month. Enough has been doing, however, to preserve a good healthy tone to the market, and a great many dealers seem to think that for the season the distribution is unusually large and general in character. Former rates have been asked, with a positive degree of firmness shown in nearly all cases, and the desirable supplies have been moderate, with few additions likely for some time to come.

In the paint market the movement has settled down apparently to the ordinary jobbing parcels required on regular trade wants. This basis, however, has given business a fairly active tone, and of all standard grades enough has gone out to prevent any serious accumulation of stock. Values have shown scarcely any fluctuation, and may be considered steady, though to increase business a concession would be quite necessary.

In the metal markets American pig iron has not been very active, and the majority of buyers have been moving mainly to the extent of immediate wants only, against which there has been an ample offering, with something to spare even after free deliveries have been made on contracts. Values under the circumstances have lacked buoyancy, though held along on a fairly level basis, with sellers claiming much firmness left in the position and no danger of a decline. Scotch pig has sold to a fair extent, but of late the demand has appeared to fall off quite materially, and the market had a comparatively dull tone, with stocks tending toward an accumulation. Prices have been without decided decline, but have weakened off somewhat on a few brands. Manufactured iron has had a first-rate sale according to most reports, and has commanded full rates, with the market generally considered in good shape. Domestic pig lead has been going out in jobbing lots to some extent, but very few parcels have been wanted, and prices have weakened off a trifle. Pig tin has given way on values under the pressure of increased arrivals, and some effort to realize from vessel. Holders have not, however, weakened in all cases, and some have refused to offer stocks at ruling valuations. Tin plates have been quite firm, with the tendency in sellers' favor than otherwise, but the demand has not been active and has been confined in the main to parcels required for immediate use, or to complete assortments. Sheet zinc has had a uniform sale, and is quoted firm.

Home Department.

The Physiology of Vision.

The following instructive and entertaining discourse on the physiology of vision, from the pen of Dr. George C. Harlan, Surgeon to the Wills Eye Hospital, Philadelphia, is abstracted from his valuable and popular treatise entitled, "Eyesight, and How to Care for It." For permission to republish the same, and for the use of the illustrations accompanying it, we acknowledge our obligations to the publisher, Presley Blakiston of Philadelphia.

The act of seeing was involved in the mystery with which all vital functions were in former times invested, until the great astronomer, Kepler, first recognized the fact that the eye is a camera, and, as such, is subject

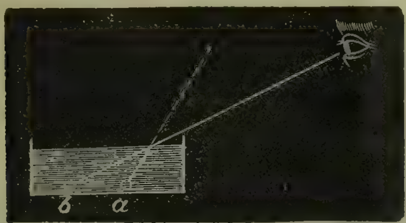


Fig. 1.—Refraction at Surface of Water Shown by "Coin Experiment."

to the same physical laws as any other optical instrument. Images of external objects are formed by the eye exactly as they are formed by a photographer's apparatus; in the latter they fall upon a chemically sensitive plate, and are made permanent by the chemical changes induced by light; in the eye they fall upon the nervously sensitive retina, and their impression is conveyed to the brain by the fibers of the optic nerve.

To understand anything of the physiology of vision, it is necessary to have a general idea of the way in which images of objects are formed by refracting surfaces. Light emitted from luminous bodies, or reflected from the surface of non-luminous bodies, moves in straight lines, and the smallest conceivable line of light is called a *ray*. Rays of light, then, are merely suppositious lines used by opticians to enable them to bring the effects of an intangible force within the range of mathematical calculations, and to study its exact and unalterable laws.

A ray of light is always a straight line while it remains in the same medium, or passes through another medium of the same density; but when it passes to a medium of different density, as from air to water or glass, its direction is at once changed. This is well illustrated by a simple experiment with which most people have amused themselves in childhood. Put a small coin in the bottom of an empty vessel, and place the

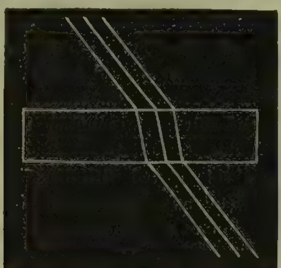


Fig. 2.

eye in such a position that the coin is just concealed by the edge of the vessel; then let some one pour water into the vessel, and the coin will come into view. The rays of light coming from the coin, as they pass from the denser medium of water to the rarer medium of air, are bent, or *refracted*, at the surface of the former, and take such a direction that it is possible for them to reach the eye. The object is seen in the direction in which the light reaches the eye, and the coin, situated at *a*, will appear to be at *b* (Fig. 1). Refraction of light is the change of direction which its rays undergo in passing from one medium through another of different density.

The new direction of a refracted ray is determined by the density of the new medium and the form of its surface. A number of parallel rays, or beam of light, passing from the air through a piece of glass with parallel sides, have their general direction displaced, but emerge still parallel on the other side (Fig. 2). If the surfaces of the glass are curved, and not parallel, the rays are either diverged or converged (Fig. 3). If, as in the case of the camera or the eye, the refracting surfaces are convex, the rays are brought together on the opposite side at a point called the *focus*. The focus of a common "burning-glass," in direct sunlight, is simply a minute image of the sun.

A bundle of divergent rays, or *pencil of light*, proceeds from every point on the surface of a visible object, and each one of these pencils may be brought to a focus by a convex lens. The combination of the focii of all the points on the surface of the object will optically reproduce the object, or form an image of it. Thus (Fig. 4) the pencil of rays proceeding from *a* are brought to a focus at *x*; those proceeding from *b* at *y*, and those proceeding from every point between *a* and *b* at a corresponding point between *x* and *y*. In this way the picture is formed in a camera, which, in its simplest form, consists of a box with its inner surface blackened, a hole in the front in which a convex lens is placed, and a white surface on the back to receive the image that the lens forms of an object towards which it may be directed. In the eye, the sides of the box are represented by the sclerotic, the blackened inner surface by the pigment of the choroid, the opening by the pupil, the convex lens by the cornea and crystalline, and the surface to receive the image by the retina. Fig. 5 illustrates the formation of an image by this living camera.

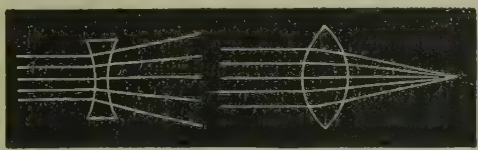


Fig. 3.

Thus far the act of vision is a strictly physical process; the rays of light can be traced to the image on the retina as definitely and accurately as they can be followed to the screen of the magic-lantern or the plate of the photographer's camera. But beyond this point we find ourselves in the misty region of theory and speculation, and the something that enables the image to excite a sensation, and converts the sensation into a mental process—that evolves thought and reason—like an *ignis fatuus*, eludes the grasp of science. Prof. Tyndall says that science not only does not explain it, but does not even tend to explain it, and that "when we endeavor to pass from the phenomena of physics to those of thought, we meet a problem which transcends any conceivable expression of the powers we now possess. We may think of the subject again and again—it eludes all intellectual presentation—we stand at length face to face with the incomprehensible."

It will be seen by the figure that the image formed on the retina is inverted—upside down; and there has been much learned discussion as to the manner in which we receive from it the impression of an erect object. It must be remembered that, after all, it is the brain that sees, and that it sees not, strictly speaking, the external object, but what is called the "projection outward" of its image on the retina, just as we see the picture of the magic-lantern slide projected on the wall. Under favorable conditions, this projected image corresponds in position to the object itself; but those conditions are easily disturbed, when it becomes plain enough that we do not really see the object itself, but only, as it were, a phantom representation of it. If we look at an object through a prism, the rays of light coming from it are deflected, and, as the image is projected along the last direction of the rays, we see the object in a place where we know it is not, while the position actually occupied by it is blank. The sportsman who wishes to shoot a fish at the bottom of a pond, does not aim at the phantom fish, but at the point where he knows the real fish must be, (see Fig. 1). As the rays of light are crossed in the eye, the inverted retinal picture is projected erect, just as the inverted magic-lantern picture is, and for the same reason.

Vision is possible even without a retinal image, for an excited or disordered brain may project some phantasm of its own conjuring—some "dagger of the mind"—and see it as distinctly as if it were a tangible object; hence there have been many honest witnesses to impossible occurrences, whose falsehoods have been, not moral, but purely physiological.

All parts of the retina are not equally sensitive to visual impressions. The most sensitive portion is a small space directly in the line of vision, called the *yellow spot*, from a yellow tinge seen in it after death. Indeed, this is the only portion of the retina that admits of distinct vision, and vision becomes gradually

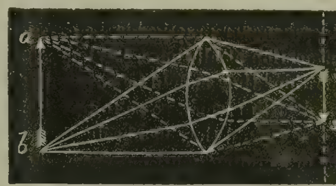


Fig. 4.—Formation of Image by Convex Lens.

more and more obscure from this point towards the circumference. When we look at a large object or a landscape, we see only a small portion of it at a time distinctly, and "the image that we receive by the eye is like a picture, minutely finished in the center, but only roughly sketched in at the borders." In reading, it is necessary to move the eyes backward and forward along the lines of the print, for without this movement we can distinguish not more than one long word. When we look at an object, we place the eye in such a position in reference to it that its image falls upon the yellow spot, and to obtain an accurate idea of our surroundings, the eyes must be in continuous though unconscious motion. This necessity for frequent shifting of the line of vision has much to do with the expression of the face. A person of sprightly temperament and active mind wishes to "take in" all that is going on about him, and moves his eyes quickly from object to object, to bring them all in rapid succession in the range of his yellow spot; while dull or phlegmatic people are satisfied with a general view of things, and do not take the trouble to focus them all in succession sharply on the most sensitive part of the retina.

(*Conclusion Next Month.*)

How the French Workman Lives.

The French laborer probably gets more for his wages than any other. His food is cheaper and more

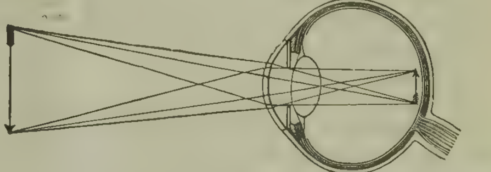


Fig. 5.—Formation of Image on Retina (*Whalley*).

nourishing. His bouillon is the liquid essence of beef at a penny per bowl. His bread at the restaurant is thrown in without any charge, and is the best in the world. His hot coffee and milk is peddled about the streets in the morning at a sou per cup. It is coffee not slops. His half bottle of claret is thrown in at a meal costing twelve cents. For a few cents he may enjoy an evening at one of the many minor theaters, with his coffee free. Sixpence pays for a nicely cushioned seat at the theater. No gallery gods, no peanuts, pipe-smoke, drunkenness, yelling or howling. The Jardin des Plantes, the vast galleries and museums of of the Louvre, Hotel Cluny, palace of the Luxumbourg and Versailles, are free to him to enter. Art and science hold out to him their choicest treasures at a small cost, or no cost at all. French economy and

frugality do not mean the constant retrenchment and self-denial which would deprive life of everything which makes it worth living for. Economy in France, more than any other country, means a utilization of what America throws away, but it does not mean a pinching process of reducing life to a barren existence of work and bread and water.

New York Health Board Rules for Plumbers.

Under the new law for the registration of plumbers and the inspection of plumbing by the Board of Health, the board has adopted the following regulations:

Whenever any plumbing work is completed, and before it is covered from view, the board must be notified in order that it may send an inspector. The arrangement of soil and waste pipes must be as direct as possible. The drain, soil, and waste pipes and the traps should, whenever practicable, be exposed to view for ready inspection at all times. When placed within walls or partitions they should be covered with woodwork fastened with screws, so as to be readily removed. In no case should they be absolutely inaccessible. Every house or building must be separately and independently connected with the street sewer by an iron pipe calked with lead. The house drain must be of iron, with a fall of at least half an inch to the foot if possible. It must be provided with a running trap placed at an accessible point near the front of the house, and there should be an inlet for fresh air entering the drain just inside the trap of at least four inches in diameter, leading to the outer air, and opening at any convenient place not too near a window. No brick, sheet metal, or earthenware flue shall be used as a sewer ventilator, nor shall any chimney-flue be used for this purpose. Every soil pipe and waste pipe must be of iron, and must extend at least two feet above the highest part of the roof or coping, of undiminished size, with a return bend or cowl. Horizontal soil and waste pipes are prohibited. All iron pipes must be sound, free from holes, and of a uniform thickness of not less than one-eight of an inch for a diameter of two, three, or four inches, or five thirty-seconds of an inch for a diameter of five or six inches. Before they are connected they must be thoroughly coated inside and outside with coal tar pitch, applied hot, or some other equivalent substance. Iron pipes before being connected with fixtures, should have openings stopped and be filled with water and allowed to stand twenty-four hours for inspection.

All joints in the drain pipes, soil pipes, and waste pipes must be so calked with oakum and lead, or with cement made of iron filings and sal-ammoniac, as to make them impermeable to gases. All connections of lead with iron pipes should be made with a brass sleeve or ferrule, of the same size as the lead pipe, put in the hub of the branch of the iron pipe, and calked in with lead. The lead pipe should be attached to the ferrule by a wiped joint. Every sink, basin, wash-tray, bath, safe, and every tub or set of tubs must be separately and effectively trapped, and the traps must be placed as near the fixtures as practicable. Traps should be protected from siphonage by a special metallic air pipe not less than one inch and a half in diameter. Every safe under a washstand, bath, water-closet, or other fixture must be drained by a special pipe not directly connected with any soil pipe, waste pipe, drain, or sewer, but discharging into an open sink upon the cellar floor or outside the house. All water-closets inside the house must be supplied with water from a special tank or cistern, the water of which is not used for any other purpose. The closets must never be supplied direct from the Croton supply pipes. A group of closets may be supplied from one tank, if on the same floor and contiguous. The overflow pipes from tanks should discharge into an open sink or into the bowl of the closet itself, not into the soil or waste pipe, nor into the drain or sewer. When the pressure of the Croton is not sufficient to supply these tanks a pump must be provided. Rain water leaders must never be used as soil, waste, or vent pipes, nor shall any soil waste or vent pipe be used as a leader. No steam exhaust will be allowed to connect with any soil or waste pipe. Cellar and foundation walls should be rendered impervious to dampness by the use of asphaltum or coal-tar pitch in addition to hydraulic cement. Yards and areas should always be properly graded, cemented, flagged, or well paved, and drained by pipes discharging into the house drain. These pipes should be effectively trapped.

The American Institute Fair.

The semi-centennial fair of the American Institute has been very successful. The attractions are many, and there are some very interesting exhibits. Machinery Hall is particularly interesting, there being a number of novelties shown. The art gallery is a very good feature of the fair; and another which all lovers of music enjoy is the grand concert given every afternoon from 3 to 5 o'clock, and every evening from 8 to 10, at which hour the fair closes. The music is furnished by M. Arbuckle's Ninth Regiment Band. The cornet solos by Arbuckle are very enjoyable. Solos are also played on the clarionette by Karl Kegel, on the euphonium by J. G. Frank, on the saxophone by F. Lipp and Mons. Reine, and on the cornet by Wm. Griffin.

We find quite a number of interesting exhibits have been placed since our October issue, embracing several of sufficient merit to deserve special mention. Conspicuous among these is a very fine display by C. H. Delamater & Co., of this city, embracing their admirable steam pump and the Ericsson coloric pumping engine. The Hartford Engineering Co., of Hartford, Ct., show the Hartford automatic cut-off engine; also the Medart pulley. B. F. Sturtevant, of Boston, has a large display of fan blowers and exhaust fans, embodying the various well-known styles of his manufacture. T. F. Rowland, of Greenpoint, L. I., has a handsome engine on exhibition in operation, as have also the Lambertville Iron Works, of Lambertville, N. J., who display their automatic cut-off engine. Julius Jonson & Co., of this city, show a fine line of their specialties, prominent among which are their hydrant and water valve. S. J. Pardessus & Co., of this city, in the main exhibition hall, display six styles of their ventilating skylights, including the plain style with ventilating attachment, and their celebrated glass dome skylights, also with ventilator. The Gold Heater Manufacturing Co., of this city, exhibit their heaters in several styles. The excellence of these appliances has already been made the subject of an article in these columns.

Taken altogether, the exhibit of the present year is the best the people of our city have been treated to for several years. We hope, however, that the managers will take a hint from our Eastern neighbors and give us an exhibition in the near future that will equal in beauty and extent the two splendid fairs now in progress in Boston.

Miscellaneous and Advertising.

A Model Cheap Cottage.

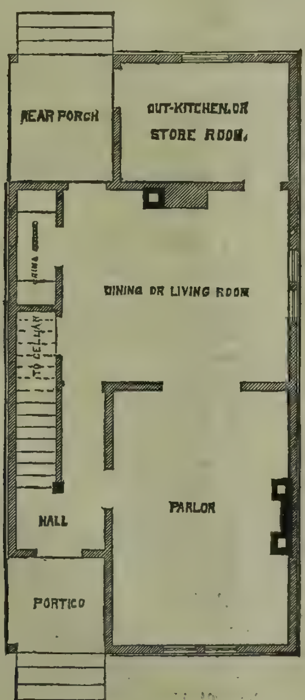
In response to the urgent request of many of our readers, we have secured for our architectural department this month another of those artistic and admirably arranged cottage designs for which at present there exists an unusually widespread demand. Houses of this character find a readier sale or rental than dwellings of any other class, as they afford the most extensive conveniences and the greatest beauty attainable at so low a cost. We believe it will be generally acknowledged that in this direction the Manufacturer and Builder has catered more liberally and effectively to the demands of the day than any other publication, aiming to convert the rent-payer into the property-owner, and giving its patrons the advantages of the best professional talent.

The cottage represented on the opposite page is one of a series of twelve now in course of erection in one of the suburbs of this city, costing from $1,000 to $1,500. Under the most skillful management, this cottage can be built for from $1,000 to $1,200. It is built in a thorough and substantial manner throughout, the frame being double sheathed and covered with clapboards, and the roof slated with best roofing slates. A cellar may extend under the entire main building, or the front portion only. In the construction, much ingenuity has been exercised to produce the best effects from the least expenditure of materials and labor. Throughout every department of the work the most assiduous thought has been bestowed to make every dollar expended tell.

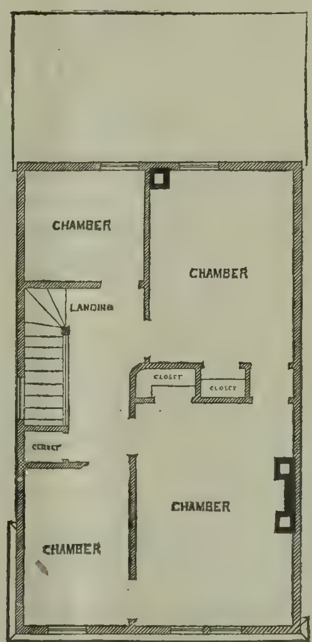
The internal arrangement is well explained by the accompanying floor plans. It will be noticed that the house contains seven rooms, all of fair size and of convenient access and pleasant communication. By a very slight modification, the arrangement can be adapted to double construction, reversing the arrangement of one building. This would not only reduce the cost of the two buildings, but would afford more available space to the plot.

The architect of this design is Horace G. Knapp, of 61 Broadway, New York.

DESIGN FOR COTTAGE, COSTING $1,000 TO $1,500.



Plan of First Floor.



Plan of Second Floor.

Gathering Rubber in Colombia.

Consul Smith of Cartagena has sent to the State Department an interesting sketch of the manner in which the natives of the South American States of Colombia extract milk from the rubber trees and prepare it for the market. Before entering the woods, the rubber hunters provide themselves with guns, ammunition, flour, salt and tobacco. The flour is made from plantains, is generally mixed with corn meal, and will keep for months. When the locality for a camp is decided upon, a roof of palm is speedily made, and, the camp being established, every man starts out with a gun and machete, each in a different direction, in search of rubber and game. When a rubber tree is found, a space is cleared from the roots by cutting away vines, under-brush, etc., and the finder moves on in search of other trees, not returning to camp until night. Custom decides that the rubber tree belongs to the man who has cut around it.

When all the trees in the vicinity of the camp have been discovered, the work of gathering the rubber begins. Before tapping the tree, a hole is dug in the ground close to it, unless another party is camped near, in which case the hole is dug near the camp of the owner of the tree. The bark of the tree is first cut with a machete as high as a man can reach, the cut being in the form of the letter V. The milk is caught as it exudes, and is deposited in the holes previously dug in the ground. When the milk ceases to flow from the cuts, the tree is chopped down and its trunk raised from the ground by means of a rude trestle. After placing large leaves on the ground under the tree to catch the sap, gashes are cut through the entire length of it, and the milk that exudes from the gashes is carefully collected and deposited in the vat. When it first exudes the sap is of the whiteness and consistency of cream, but it turns black upon exposure to the air and light if not properly watched. The quantity of milk put into one hole depends on the size of the trees, their distance from each other, and the strength of the man who is to carry the rubber to the river. When the hole is filled with rubber, it is coagulated by adding the root of mechoacan, hard soap, etc. These substances cause the milk to coagulate so rapidly as to prevent the escape of the water, which is always present in the fresh sap, and as the rubber and water will not mix, a piece of rubber coagulated in this way is always filled by small cells, which reduces its commercial value. When coagulated, the rubber is strapped on the backs of the hunters with bark thongs, carried by them to the banks of the river, and floated to market in canoes or on rafts.

The annual destruction of rubber trees in Colombia is very great, and as the people have not turned their attention to planting trees to supply the wastage, there is some apprehension that this industry will be seriously crippled before many years unless the Colombian government enforces its regulations against the destruction of forest trees, and compels hunters for rubber to tap without destroying the trees by cutting them down. Consul Smith thinks there is a good chance for profitable investment in this direction. He says there are places on the Sinu river where rubber trees will grow from eight to ten inches in diameter in three or four years from the seed. The trees require little attention, and begin to give returns sooner than almost any other. The trees that yield the greatest amount of rubber flourish along the banks of the Sinu and Aslato rivers.

The reports of the Bureau of Statistics show that the value of crude india rubber annually imported into the United States is about $10,000,000.

American Success at the Electric Exhibition.

In advance of the official publication of the awards at the International Exhibition of Electricity, the Paris correspondent of the *Herald* has cabled the names of the successful exhibitors from this country. As a mark of the highest distinction, diplomas of honor have been awarded to the United States Signal Office, the Smithsonian Institution, the United States Patent Office, and Messrs. Edison and Graham Bell. Gold medals are awarded to the Anglo-American and Brush Electric Light companies, the United States Electric Lighting Co., Elisha Gray, and Tainter. Silver medals to Bailey & Puskas, Connolly Brothers & MacTighe, Dolbear, Eccard, Electric Purifier Co., Hubbard Pond Indicator Co., Western Electric Manufacturing Co., Weston Electric Light Co., and the Electro-Dynamic Co. Bronze medals to Chavet, Cumming, and Dion, the Hoosac Tunnel Co., Trinitro-Glycerine Works, L. G. Tillotson & Co., Partz, Photo-Relievo Co., Whitehouse, Mills, and Williams.

If the relatively small number of American exhibitors be considered, it will be seen that they have carried off a very large number of prizes. The awards have been made for the *ensemble* of each exhibitor's contribution, not for any single invention exhibited, except, of course, where there was only one.

Proposed International Exhibition in China.

It is reported that an international exhibition will take place at Shanghai in 1883, in imitation, more or less, of the Melbourne and Sydney displays. Though a somewhat hazardous experiment, it is said that the organizers feel certain of success, on account of the growing appreciation of the importance of the Chinese market by European and American manufacturers.

New Publications.

A Study of Various Sources of Sugars; Sugar Cane, Sorghums, Sugar beet, Maple, Watermelon, etc. By Lewis S. Ware, Member of the American Chemical Society, etc. Philadelphia: H. C. Baird & Co. 1881. 66 pages, 8vo. Price, 50 cents.

The writer, already well known by his work upon the sugar beet, examines into the various sources of supplies of sugar, and especially of those deemed valuable for this country. In the preface, he states that the United States has thus far been unable to achieve its industrial and financial independence, the results being periodic monetary crises and paralysis of industries because of our debt to Europe. As sugar is the largest single import into this country, the author thinks that Northern sugar culture offers a greater field of usefulness than any other for the development of the great national aim.

Mr. Ware states that the impurities in sorghum will prevent four to five times their weight from crystallizing. The fact is, that six is nearer the figure. In his calculations, he considers that one equivalent of impurity will neutralize only one of crystallizable sugar, which is certainly fair enough from an earnest advocate of beet sugar.

A very valuable synopsis of the government experiments at Washington in 1879, is given, from which we glean that more than one half of all the experiments made with sorghum, yielded 0 per cent of sugar, and that the average of 111 experiments was but 4.5 per cent of practical sugar, proving the sorghum problem impossible. In the government experiments of 1880, (quoted on page 19), and including 3,601 experiments in every State in the Union, it seems the average was only 3.3 per cent, still further condemning sorghum as a sugar-yielding plant.

Attention is called to the fact that the Agricultural Department at Washington for many years gave the supposed yearly production of sorghum sugar in the United States as amounting to 3,200,814 pounds from 1861 to 1867 inclusive, or an average of 177,170 pounds per year; but letter after letter to that department, asking for the total production of sugar in 1878, 1879 and 1880, brought no reply except the sorghum report above referred to, giving the per cent of sugar but not production in pounds.

In reference to corn-stalk sugar, it is proved not to exist. Watermelons, sweet potatoes, etc., are shown to be useless as Northern sugar-producing plants, as they never arrive at a state of maturity. The maple tree is shown by calculations to requre one tree for every three pounds of sugar, which would require for the sugar consumption of the United States (which was 1,692,299,758 pounds in 1877), 564,066,583 trees. As two men can only take care of 300 trees, there would, at this rate, be required 3,760,443 men for tapping alone; or for tapping, boiling, etc., over 7,000,000 men.

Comparative calculations are made between the cost of making cane and beet sugar, etc.

The other sources of sugar spoken of more or less fully, are the amber cane, the sweet potato, pine, acorn, palm, etc. The author is convinced that the sugar beet alone can supply the American market, and calculations are made showing its adaptability in every respect. The writer urges the discontinuance of the experiments with sorghum at Washington, as they have not yet, and never will, demonstrate the feasibility of sorghum sugar manufacture.

Portrait of Dr. Holland. Published by the Century Company, New York.

The portrait of Dr. Holland, by Wyatt Eaton, which the Century Company offer on special terms to subscribers to *The Century Magazine* (*Scribner's Monthly*), is a life-size photograph from the original crayon drawing, showing nearly the full face and part of the shoulders. Considered only as an exceptionally fine specimen of the art of photography in America, this picture is of great interest. It has, moreover, an intrinsic art value as an exact reproduction of the work of one of the best portrait painters of America; and it will be welcomed for its subject in many homes where the writings of Dr. Holland are "familiar as household words." A leading New York critic says: "Perfect restfulness, and a dignity that few painters attain, are the traits of portraits done by Mr. Wyatt Eaton. The latest crayon head of a poet in the series of American men of mark on which he has been engaged, is that of Dr. Holland. He has kept, in this case, a middle ground between the flowing locks and King-Lear-like appearance of his picture of Bryant and the rough-hewn, massive picture by which he commemorated Lincoln. It is a matter that tells of the times, that a thoughtful artist like Eaton should picture a popular novelist and poet so solid and sturdy of look."

It should be said that it was at the suggestion of the artist that the portrait is reproduced by photography rather than by engraving. While a life-size photograph like this is more expensive in the printing, the result is in every way more artistic and satisfactory.

[The sudden death of Dr. Holland lends a new interest and value to this portrait, which, as the public are aware, had been announced some weeks before his decease.]

Practical Lessons in Architectural Drawing; or, How to Make the Working Drawings for Buildings, etc. By Wm. B. Tuthill, A. M., Architect. Wm. T. Comstock, Publisher, 194 Broadway, New York. Price, $2.50.

We have been favored with a number of advance sheets of the above work, which is in press at the time of this writing, and will be ready for distribution about November 15th, and find it, both in conception and execution, worthy of unqualified praise. The material embraced in this volume, if we may judge from careful examination of the sample sheets sent us, promises to be entirely new and original, and not the mere re-hash of a literary hack, which is too often the characteristic of so-called "practical" treatises; and if the promising evidences of the specimen sheets in our hands are borne out by those that are forthcoming, the work will be really a most useful book of instruction. From the announcement of the publisher, we glean that the completed work will be illustrated by 33 full-page plates and 33 wood engravings showing methods of construction and representation. It will embrace scale drawings of plans, elevations, sections and details of frame, brick and stone buildings, with full descriptions and a form of specification adapted to the same.

In the design and execution of the volume, it has been the author's study to suit the wants of architectural students, carpenters, builders, and of all whose pursuits or inclinations might make the acquisition of a thorough knowledge of architectural drawing and construction necessary or desirable.

Christian Union. New York: New York & Brooklyn Publishing Co., Limited.

The *Christian Union* for October 19th is enriched with a handsome four-page supplement describing the model farm of Mr. Lawson Valentine, in Orange county, New York, the text being by Lyman Abbott and the illustrations by F. S. Church, while the best art of the Riverside Press, Cambridge, Mass., has been bestowed upon the typography and press-work. Readers of the paper will no doubt be surprised to learn of the existence of so important an agricultural enterprise near New York, and will be interested in knowing of the various experiments in farming which are there in progress.

With the issue of October 26th, Rev. Henry Ward Beecher, for twelve years the editor of this paper, announces his retirement. The editorial conduct is now under the sole charge of Rev. Lyman Abbott.

OTHER PUBLICATIONS RECEIVED.

Reports of the Inspectors of Mines of the Anthracite Regions of Pennsylvania, for the year 1880. Harrisburg: State Print. 1881. From the Hon. James Gay Gordon, Philadelphia.

Underwood's Counterfeit Detector for September, 1881. From the publisher.

Circulars of Information of the Bureau of Education. No. 6. 1880. Washington: Government Print. 1881. From the Commissioner of Education.

Annual Report of the Astronomers in charge of the Horological and Thermometrical Bureau of the Winchester Observatory of Yale College. 1880–1881. New Haven. 1881. From Leonard Waldo.

Agriculture of Pennsylvania (containing the reports of various agricultural societies and institutions throughout the State) for 1880. Harrisburg: State Print. 1881. From Hon. James Gay Gordon, Philadelphia.

Second Geological Survey of Pennsylvania. The following volumes: A 2, Coal Waste; G 4, Clinton County; H 6, Jefferson County; P, Coal Flora Text; Q 4, Erie and Crawford; T, Blair County. From Hon. James Gay Gordon.

Various papers read before the Virginia meeting of the American Institute of Mining Engineers. From Dr. Thomas M. Drown, Secretary, Easton, Pa.

Florida Land Improvement Company Prospectus and Map. From James M. Kraemer, Engineer, Philadelphia.

Summary Statement of the Imports and Exports of the United States, for the month ended July 31, 1881, and for the seven months ended the same, compared with the corresponding periods of 1880. Prepared and published by the United States Bureau of Statistics. [Corrected to September 16, 1881].

Correspondence.

MILES OF TELEGRAPH.

To the Editor of the Manufacturer and Builder:

I am inclined to think that the printer made a mistake in seting up the tipe for No. ov milez ov telegraf in the United States, on page 238. L. L.

Conneaut, O., October 20, 1881.

[The statement referred to by our phonetic correspondent is approximately correct in giving the number of miles of telegraph *lines* in this country, at the beginning of the present year, as 170,103 miles. The statement which follows, that "about 30,000 miles of *wire* are in use on these lines," is obviously incorrect. It is a typographical error for 300,000. It is very difficult to maintain strict accuracy in statements of the above nature; but we feel tolerably well assured that the figures of telegraph lines in the United States stated in the article referred to, are under rather than over the truth. We have not just at hand the figures of the last annual report of the great company that has the monopoly of the bulk of the telegraphic business of the country; but in the latest report that we have, namely, that for the year ending June 30th, 1877, the Western Union Company operated 76,955 miles of line and 194,323 miles of *wire*. Since that time the lines of this company have been enormously enlarged, both by extensions and by purchase of the newly erected lines of Gould's great American Union telegraphic stock-gamble company; so that it is safe to say that the Western Union Company alone now owns, or operates, not less than 125,000 miles of line. The lines of other companies doing public business, we feel assured, will bring up the total to the figures of 170,000 miles.—*Ed. M. & B.*]

THE IRISH AND THE USEFUL ARTS.

To the Editor of the Manufacturer and Builder:

Your paragraph on this subject (published in your August number), is misleading. The Irish have done as much as the misgovernment of a stronger and a truculent people permitted. "I fear the Greeks and the gifts they bring," said the old Trojan, and no doubt some similar dose from experience worked the Irish. From personal observation, I say the Irish do not dislike trades and manufactures. As to their being bigots, England, sword in hand, made them so; but they are fast improving. Kirby.

Jersey City, September 28, 1881.

[It is no doubt true, as Kirby suggests, that the low state of the industrial arts in Ireland is to be ascribed in a great degree to the repressive measures directly exerted by England, and to other causes directly referable to the lamentable misgovernment of Ireland by the latter country. It is not improbable, also, that under a better condition of things, in which the country would be free to develop its internal resources, trades, manufactures and the fine arts might in time reach a high stage of development in that country. At present, however, whatever may be the cause, the statements contained in the paragraph criticised by Kirby are substantially true.—*Ed. M. & B.*]

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of The Manufacturer and Builder. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2893) Leather Cement.—Please inform me how to make a first-class leather cement—something that will be transparent and have a color on it like whiskey, and how it is to be used for repairing boots, shoes, belting, etc., and greatly oblige.—M. J. D., East Boston, Mass.

(2894) Stereotyping and Electrotyping.—What is the difference between stereotyping and electrotyping?—M. H., Bennington, Vt.

(2895) Transmission of Power.—Replies to the following questions will be duly appreciated: 1. On what does the horse-power of a belt depend, speed being equal—on width, arc, or surface of contact? Abernathey says arc, irrespective of pulley diameter. 2. The same authority, in his "Practical Hints on Mill-Building," (p. 132), gives in a table the horse-power transmitted by a 48-inch single leather belt, running 6,200 feet per minute. He states it as 238.08 horse-power with 90° contact, and 343.32 with 180° wrap. How does he know? 3. Are there any 48-inch single leather belts? 4. Could any 48-inch belt run 6,200 feet (about 1⅕ miles) per minute? 5. Abernathey quotes (p. 142) a 3½-inch shaft running 2,100 turns per minute as giving off 2,251 horse-power. Could a 3½-inch shaft run that fast, or half that fast, without fairly welding tight and twisting off?—B. W. P., Philadelphia, Pa.

(2896) Fire-Proofing Combustible Materials.—Will you please publish what is regarded the best solution or application for making wood-work and woven goods fire-proof?—A. M. R., Newville, Pa.

(2897) Tin in the United States.—Which of the United States produces the largest quantity of tin? Where are the best mines located?—J. A. F., Portland, Me.

(2898) Druggists' Scales.—I wish to know how druggists' scales are made. Would you be kind enough to give a small sketch of one, and oblige a constant reader.—A. B., Jersey City, N. J.

(2899) Coal Consumption on Ocean Steamships.—Will you please inform me how many tons of coal are used by an ocean steamer on a trip from New York to Liverpool, or, *vice versa*, from Liverpool to New York.—W. H. F., Mobile, Ala.

(2900) Incrustation of Brick Walls.—In the December number for 1880, of your journal, I see a question from B. F. M., on incrustation of brick walls, and also your reply. Can you give me any further information on the subject, as I am troubled in the same way with a brick building. What kind of a wash can I use to get rid of it permanently, or temporarily? By answering this you will greatly oblige an old subscriber.—A. G. F., Providence, R. I.

(2901) To Detect Magnesian Lime.—I would like to know how I can detect magnesian lime, which you say slakes easily. Shall I have to throw away all limes that slake easily? or is there some way by which I can tell it by sight?—A. G. F., Providence, R. I.

(2902) Mixing Paints of Various Colors.—Can you refer me to any manual giving instructions in the art of mixing different colored paints to produce different shades?—A. L., Conshohocken, Pa.

(2903) A New Photometric Unit.—I remember reading somewhere in your useful journal, in connection with the candle-power of illuminating gas, a suggestion of Prof. Draper's to discard the standard candle and substitute, as a more reliable and constant unit, the light given out by a platinum surface heated by an electric current. Can you refer me to Prof. Draper's original paper, or give me the details of his plan?—M. C. C., Columbus, O.

(2904) Recording the Blows of a Steam Hammer.—Can you suggest to one of your readers a simple mode of recording the blows of a rapid-striking steam hammer? I find that when the strokes reach about four to five per second, counting cannot be depended on for accuracy, as two observers seldom agree.—J. McC., Cleveland, O.

(2905) Solution of Shellac in Water.—Is there any way of making a solution of shellac in water?—V. C. H., Yonkers, N. Y.

(2906) Luminous Paint.—Can you give me a good formula for preparing the so-called luminous paint?—O. W. C., Atlanta, Ga.

(2907) A Spontaneous Explosive.—Can you suggest to an amateur chemist a substance or mixture that will explode spontaneously, and that could be safely presented as a lecture experiment?—B. S., Westchester, Pa.

(2908) Cement for Alabaster.—Please give me a receipt for cementing objects of alabaster, and oblige.—W. T., New Brunswick, N. J.

REPLIES.

(2867) Fire-Proofing Shingle Roofs.—In reference to the Query on this subject, in our issue for September, we have received from a correspondent a note setting forth the merits of a product of the Dixon Crucible Company, of Jersey City, and known as "Dixon's Silico-Graphite Everlasting Paint," and which is claimed to be admirably adapted for preserving roofs whether of shingles or metal, and to be far superior to the fire-proofing applications named in our previous reply. This material is represented to be a very cheap and durable paint for every species of outside work, whether of wood or metal. The basis of the paint is affirmed to be fine American graphite, taken from the Dixon company's mines at Ticonderoga, N. Y., and on account of the well-known durable qualities of this substance, the claim is made that the paint prepared from it will retain its protective influence unimpaired for an indefinite period, effectually preventing the oxidation of iron and other metals and the decay of wood. The natural color of the paint is slate, but it is prepared in a variety of dark shades. The foregoing representations of our correspondent may possibly be of service to W. R. T.

(2893) Leather Cement.—We give this inquirer several highly recommended cements for uniting leather to leather and other materials, from which he may select one or more that will best answer his purpose, viz.:

Cement for Leather Belting.—Soak common glue and isinglass (equal parts) for about ten hours in just enough water to cover them. Bring gradually to a boiling heat, and add tannin until the mass becomes ropy. Buff off the surfaces of the leather where it is to be cemented; apply the cement thoroughly to the parts to be joined; then warm the parts over a flame or fire for a few minutes; join the two parts properly, clamp firmly or weight them, and allow to remain undisturbed over night, when the belt will be ready for use. This cement is said to make a very strong joint.

Gutta-Percha Cement for Fastening Leather.—Dissolve a quantity of gutta-percha in chloroform or bisulphide of carbon until the solution has the consistency of honey. Thin down the parts to be cemented, then spread a small quantity of the cement well over the parts to be joined, warm the parts over a flame or fire for half a minute, bring the surfaces to be united together, and hammer well or clamp firmly. The cement dries in a few minutes. It can be used either for splicing leather belts or for patching shoes, boots, etc. Many shoemakers use it for the latter purpose very successfully, making a patch so deftly as almost to defy detection. It is water-proof, and will answer almost everywhere unless exposed to heat, which softens it. The bottle containing this cement should be kept well stoppered and in a cool place, otherwise the material will speedily dry out by evaporation.

Chinese Cement is a colorless cement that is recommended highly for joining glass, crockery, stone, wood, leather, etc. It is best made by covering shellac with strong liquid ammonia, and shaking frequently until dissolved. The solution takes some time to form, and is facilitated by standing, placing the bottle (well stoppered) in a moderately warm situation, and briskly agitating it at intervals. It gives a strong water-proof cement, which adheres to everything. Bleached shellac gives a lighter colored transparent solution, but the cement will not be so strong. Alcohol or wood spirit may also be used in place of the ammonia, but the cement will not be so strong as where ammonia is employed.

(2894) Stereotyping and Electrotyping.—Stereotype is the name given to a casting made in type metal of a wood-cut or other engraving in relief, or of a page of type. In general, a plaster of Paris mold is made of the engraving or page of type, which is then locked up in a casting box and immersed beneath the surface of a bath of melted type metal until the plaster mold has completely dried out and the metal has penetrated to every line of the mold. The box is then withdrawn, and the casting is removed, planed down to a proper thickness, squared, and generally mounted on a block of wood type-high for printing. This is the plan generally adopted for jobbing work; for newspapers, instead of plaster, a papier-maché mold is made; the casting process, however, is the same. The electrotype, as its name indicates, is a plate obtained by electrical means—in other words, by a plating process under the action of the electric current. In this process, a mold is first taken of the subject to be copied, in wax, which is done in a powerful press. This is properly trimmed, and then the whole surface is thoroughly dusted with graphite, which makes it a conductor of electricity. This mold of graphite is suspended in a bath of sulphate of copper, and suitably connected by copper wires with the poles of a galvanic battery. A copper film is deposited on the graphite surface under the action of the battery, and when this is thick enough, the mold is taken out, the shell removed, turned on its back, reinforced by a thick coat of stereotype metal to give it strength, properly surfaced by hammering, planed to proper thickness, squared up, and mounted on wood type-high, like the stereotype. It is then ready for the printing press. In all, or nearly all, the electrotyping foundries, the graphite mold, before being put in the battery, is first covered evenly with a thin film of copper by dusting fine iron powder over its surface and then brushing it over briskly with a solution of sulphate of copper. This is done with a very soft brush, to avoid scratching the surface. The iron decomposes the copper salt, forming sulphate of iron and precipitating metallic copper, which coats the graphite surface. This makes a better conducting surface than the graphite, and the film formed in the battery is uniform in thickness.

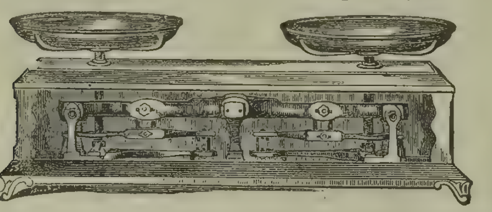
(2895) Transmission of Power.—1. The horse-power that a belt will carry at a given speed, depends, other things being equal, upon the surface in contact with the pulley. In some cases, to increase the belt power, the surface is increased by increasing either the arc of contact or the tension, without changing the belt width or the pulley diameter. In other cases a wider belt is used, with the same pulley diameter and arc of contact. In others, more surface is got by keeping the belt speed and width and arc the same, and giving greater length of belt contact with the pulley. 2. Mr. Abernathey seems to give no formula that would be of use. 3. We never heard of a 48-inch single leather belt; and 48-inch double ones are rare. Double ones are used (for grain elevators) 48 inches, and even 60 inches wide. 4. We consider 6,200 feet per minute an utterly impracticable speed for a 48-inch belt. 5. Even if unloaded, a 3½-inch shaft would ruin itself or the bearing in a very few minutes at 2,100 turns.

(2896) Fire-Proofing Combustible Materials.—A number of mineral salts have been suggested for this purpose, all of which are excellent when intelligently applied. Of these, we will name first the use of borax and sulphate of magnesia. These substances should be separately dissolved in water, so as to form a moderately dilute solution of each—say 3 parts of the salts to 25 parts of water by weight. Apply one of the salts to wood-work with a brush, and after it has dried, follow with the other; or, if to be used on woven fabrics, dip the fabric first in one solution, and when dry, plunge for an instant in the other. The action depends on the formation of a borate of magnesia, which is insoluble in hot or cold water, and which envelops and impregnates the fibers of the wood, or the threads of the tissues, and prevents their combustion. A mixture of sulphate of ammonia and sulphate of lime has been suggested for the same purpose. This mixture is to be dissolved in a suitable vessel, and applied to the wood-work with a brush, or to fabrics by dipping. Its action depends on the impregnation of

the fibers and threads with a non-inflammable substance, which prevents the propagation of flame, and partly on the liberation of ammonia at an elevated temperature which smothers the flame. The tungstate of soda has been highly recommended for this purpose by very good authorities, and is used to some extent for fire-proofing wood-work, scenery, gauze dresses, etc., in theaters. From all that we know, it has proved itself very well adapted for this use, and is perhaps the best material to employ.

(2897) Tin in the United States.—Unfortunately, there is no State of the Union in which tin has yet been found in sufficient quantity to pay for its working. Tin has been found in California, Montana, Missouri, Connecticut, Maine, and other States; and mining and smelting operations for the extraction of the metal have been undertaken in several instances, but subsequently abandoned. The most promising of these undertakings was started at Temescal, in Southern California, some eight or ten years ago. The tin ores at this locality are reported to be as rich, or richer, than those which are profitably worked at Cornwall, England, but for some reason—probably the greater cost of labor for mining, concentrating and smelting—the enterprise proved a failure, and the mine was abandoned. Lately, however, it is reported that interest in the Temascal mines has been revived, and probably another effort to work them may prove more successful. Much interest has been awakened within the past year by the reputed discovery of very promising tin deposits in our correspondent's own State, in the neighborhood of the town of Winslow. The preliminary developments that have been made, are spoken of as having shown favorable indications of the existence of an extensive body of paying ore. We trust that these favorable accounts may be verified by the results. All the tin used in this country, which, in the form of tin plate and block tin, amounts to many millions of dollars' worth annually, is imported, chiefly from England. The discovery of tin in this country in sufficient quantity to supply our home consumption of the metal, would be an event of great importance. It would keep in this country the immense sums now yearly sent abroad to pay for our colossal importations of tin plate, and would, likewise, speedily enable us to supply the home demand for this article, by developing the manufacture of tin plate in this country. So long as we are dependent on foreign sources for our supplies of this metal, our manufacturers cannot successfully compete with foreign manufacturers in this branch of industry, and all efforts to introduce the industry have thus far proved failures.

(2898) Druggists' Scales.—This inquirer sends us a rough sketch of a box scale, of a pattern in common use among druggists, and which we recognize as belonging to a style manufactured by Henry Troemner, a well-known maker of fine scales and balances, whose office and warerooms are at 710 Market street, Philadelphia. The particular scale referred to by this correspondent, is made with a special combination of levers, which is a patented invention controlled by the manufacturer. The accompanying cut shows the scale in question, with the



front removed to show the mechanism. A pointer is attached to the inner extremity of each of the lower pair of levers beneath the beam, and the equilibrium of the balance is indicated by these points standing exactly opposite to each other on the dial plate in front of the box. These pointers are not shown in this cut, the front of the box having been removed to show the interior. Our inquirer will doubtless be able to understand the operation of the scales by an examination of the engraving.

(2899) Coal Consumption on Ocean Steamers.—The coal consumption of an ocean steamer in making a trip from New York to Liverpool, or *vice versa*, will depend chiefly on the size and power of the engines, which vary very much. The duty of marine engines has been very materially increased during the past twenty-five years, and at the present time, the consumption of coal by first-class ocean steamers ought not to exceed 2 pounds of coal per indicated horse-power per hour. On the American line steamers which are only of moderate dimensions and supplied with engines of moderate power, the coal consumption is about 40 tons per day. A White Star steamer of great size, built specially for high speed, and furnished with very powerful engines, consumes about 150 tons of coal per day. The coal consumption per trip would, therefore, be approximately as follows:

	Average time of trip.	*Average coal con'ption per day.*	*Coal con-sumpt'n per trip.*
American Line (Philadelphia..	11 days.	40 tons.	440 tons.
Guion Line (Arizona)........	9 "	160 "	1,440 "
White Star Steamers..........	9 "	150 "	1,350 "

The above figures are only approximate. Our inquirer will find an interesting paper on the progress and development of the marine engine in a late number of *Engineering*, by Mr. F. C. Marshall, which was read before the August meeting of the Institution of Mechanical Engineers, at Newcastle, England, which is full of important facts and suggestions bearing on this subject.

(2900) Incrustation of Brick Walls.—We know of no way of remedying the evil complained of by this inquirer, short of painting the front, which might not be desirable. If a magnesian lime mortar has been used in the building, the whitish incrustation will persistently appear year after year until all the magnesia has been leached out of the mortar as sulphate. Nothing in the shape of a wash or external application, except a coating of paint, would be of any service. The oil of the paint would act as a water-proofing agent, preventing to a large degree the absorption of water, and thus practically doing away with the trouble. There are other methods of water-proofing brick masonry, but we do not wish to recommend them, as painting is the simplest and safest method. One of the methods which has been proposed for remedying the saline incrustation so much complained of, is to add linseed oil to the mortar, at the rate of say one gallon of oil to the barrel of lime; or if cement is used in the mortar, an additional gallon of oil for each barrel of cement. We do not wish to condemn this suggestion, never having seen a case where it has been used, but we should recommend our inquirer, if he is inclined to try it, to first test thoroughly the effect of the oil on the binding qalities of the mortar by a few trial experiments before using it on any work.

(2901) To Detect Magnesian Lime.—There is no difference apparent to the eye between a pure burnt lime and a magnesian lime. The magnesian lime, though it slakes readily, does not slake as quickly as a pure lime, and is more gelatinous or pasty than pure lime. The best practical test, however, of the character of a lime, is its setting. A pure lime mortar *sets very quickly*. The mortar of a pure lime, when laid on brick-work, soon becomes so firm—being less pasty than magnesian—that two or three bricks only can be laid before it sets, or becomes so dry as not to make a proper bond with the new brick and those already laid. With a magnesian lime mortar, on the other hand, the setting is so slow that the bricklayer, when using it, can spread out the mortar on the brick course already laid as far as he can reach without moving from his position, and without danger of his mortar setting. Our inquirer will be able from these practical hints to form a good judgment of the quality of a mortar. We do not know the character of the lime used in his neighborhood.

(2902) Mixing Paints of Various Colors.—We have no doubt that there are numerous painters' manuals, or books of instruction, in existence. The simplest plan would be for our inquirer to drop a letter to some one of the leading publishers of technical and industrial works, either in this city or in Philadelphia, asking for titles and prices of such books. D. Van Nostrand and John Wiley & Sons, of New York, or Henry Carey Baird & Co., of Philadelphia, would be good parties to address. We give the following table of compound colors, showing the simple colors which produce them, which may be of some service to our inquirer:

Buff—White, yellow ocher and red.
Chestnut—Red, black and yellow.
Chocolate—Raw umber, red and black.
Claret—Red, umber and black.
Copper—Red, yellow and black.
Dove—White, vermilion, blue and yellow.
Drab—White, yellow ocher, red and black.
Fawn—White, yellow and red.
Flesh—White, yellow ocher and vermilion.
Freestone—Red, black, yellow ocher and white.
French Gray—White, Prussian blue and lake.
Gray—White lead and black.
Gold—White, stone ocher and red.
Green Bronze—Chrome green, black and yellow.
Green Pea—White and chrome green.
Lemon—White and chrome yellow.
Limestone—White, yellow ocher, black and red.
Olive—Yellow, blue, black and white.
Orange—Yellow and red.
Peach—White and vermilion.
Pearl—White, black and blue.
Pink—White, vermilion and lake.
Purple—Violet, with more red and white.
Rose—White and madder lake.
Sandstone—White, yellow ocher, black and red.
Snuff—Yellow and Vandyke brown.
Violet—Red, blue and white.

In the foregoing table of the combinations of colors required to produce a desired tint, the first named color is always the principal ingredient, and the others follow in the order of their importance. Thus, in mixing a limestone tint, white is the principal ingredient, and red the color of which the least is needed. The exact proportions of each color must be determined by experiment with a small quantity. It is best to have the principal ingredient thick, and add to it the other paints thinner.

(2903) A New Photometric Unit.—We are not able to refer this inquirer to the original paper of Prof. John C. Draper in which he proposes a new photometric unit, but can give him the gist of the same from memory. Prof. Draper objects to the standard candle on the ground that candles can never be made that will possess exactly the same composition, on which account the light emitted from the candle used as standard for comparison will necessarily vary slightly with the same consumption, thus vitiating the result. He suggests as a substitute for the standard candle, the light emitted by an incandescent solid—a coil of platinum of given gauge and surface, maintained at a constant temperature. An incandescent solid will emit a definite and constant amount of light at certain temperatures, and it is only necessary to provide for maintaining the uniformity of the temperature in order to be assured that the light emitted is constant. To accomplish this, Prof. Draper proposes to allow a flame of pure dry hydrogen, burning at a definite rate, to strike upon the platinum coil; and he found that so long as wire of the same diameter was made up into coils of the same dimensions, and these were subjected to a flame of hydrogen burning at the same rate, the light emitted by the glowing wire was of the same intensity. There is no difficulty in maintaining a constant and uniform consumption of hydrogen, while with an electric current there would be great difficulty in maintaining its uniformity.

(2904) Recording the Blows of a Steam Hammer.—A similar difficulty in counting the blows of a rapid-striking steam hammer was noted some years ago by Mr. Coleman Sellers, a well-known mechanical engineer of Philadelphia, who also noticed the discrepancy between the figures of those who attempted to count the strokes when the blows were near 300 per minute, in which case it was found that most persons who attempted to count, over-counted rather than under-counted. Mr. Sellers having occasion to count the blows of a quick-striking hammer, supposed to make about 300 blows a minute, found that three careful observers, counting the blows at the same time, made a variation of from 275 to 325 in the same count. Finding such a wide discrepancy, he devised the following simple and ingenious method of making an accurate and automatic register of the strokes: He connected a recording telegraph instrument to the machine, placing two keys in the circuit. One key was closed by each blow of the hammer, a wire from this being attached to a rock shift in the valve motions, the other key being closed by hand. When the hand-key was closed, dots were recorded on the paper ribbon—one dot to each blow of the hammer; and by keeping the hand-key closed for a definite time, say one or two minutes, a row of dots, representing the number of blows made in that time, were recorded, which dots could be counted afterwards at leisure. Many experiments were tried with this apparatus attached, and it was found that very seldom did the count of any observer tally with the count of the instrument, the rule being, as above stated, that the observer almost invariably over-counted. An arrangement similar to that above described would fully answer our inquirer's needs.

(2905) Solution of Shellac in Water.—The following method of procedure will furnish a neutral solution of shellac in water: Break the shellac up and cover the fragments with a concentrated solution of carbonate of ammonia. Boil this mixture upon the water bath until the ammoniacal smell has disappeared. Add more of the solution of ammonia salt, and continue the boiling until the shellac forms a coherent, spongy mass; then expel the residue of carbonate of ammonia by further boiling, continued until the ammoniacal smell is no longer noticeable. The spongy mass will now be found to dissolve readily by pouring boiling water upon it. A kind of soap will be found floating on the surface, which may readily be removed by straining. The solution, brought on paper, cloth, etc., dries promptly, and leaves a thin, lustrous and adherent film of shellac behind.

(2906) Luminous Paint.—The following method of procedure will, it is said, give a very satisfactory luminous paint: Take a number of oyster-shells cleaned from organic matter as thoroughly as possible, and burn them in a strong coal fire for about half an hour, at the end of which time take them out and allow to cool. When quite cold, pound them fine, removing during this operation any particles of gray matter that may show themselves, as these are useless. When finely powdered, make an intimate mixture of this with flowers of sulphur. Introduce the mixture into a crucible, luting on a lid to the vessel with clay, or other convenient luting material. When this has dried, place the crucible in the fire and allow it to remain for an hour; then remove, and allow to cool before opening. The mixture then should appear pure white. Any gray particles that have escaped removal at the first preparation, should be removed now. The resulting powder should be mixed with gum water to a thin paint, as two thin applications are better than one thick one. This paint will remain luminous far into the night, provided it is exposed to the light during the day.

(2907) A Spontaneous Explosive.—The simplest method of preparing a mixture that will explode spontaneously, and that is unattended with danger if ordinary care is used, is to make a saturated solution of phosphorus in bisulphide of carbon, then to pour a small quantity of this solution upon some finely powdered chlorate of potassa, resting upon paper. When this mixture is exposed to the air, the bisulphide of carbon rapidly evaporates and leaves the phosphorus behind, and in a condition of intimate mixture with the chlorate, far more perfect than could be obtained by mechanical means. On the evaporation of the solvent, as above described, the mixture presently explodes spontaneously with a loud detonation. The only precaution to be taken in performing this experiment, is to avoid taking too large a quantity of the material.

(2908) Cement for Alabaster.—Parts of alabaster objects which have become disjointed, or broken parts, may be joined very satisfactorily by using a cement composed of the white of one egg mixed with a teaspoonful of quicklime. The cement should be used immediately after mixing, and the parts to be joined should be previously dampened with luke-warm water.

THE MANUFACTURER AND BUILDER.

Vol. XIII.—No. 12. DECEMBER, 1881. THIRTEENTH YEAR.

New Double Plunger Sewerage Pump.

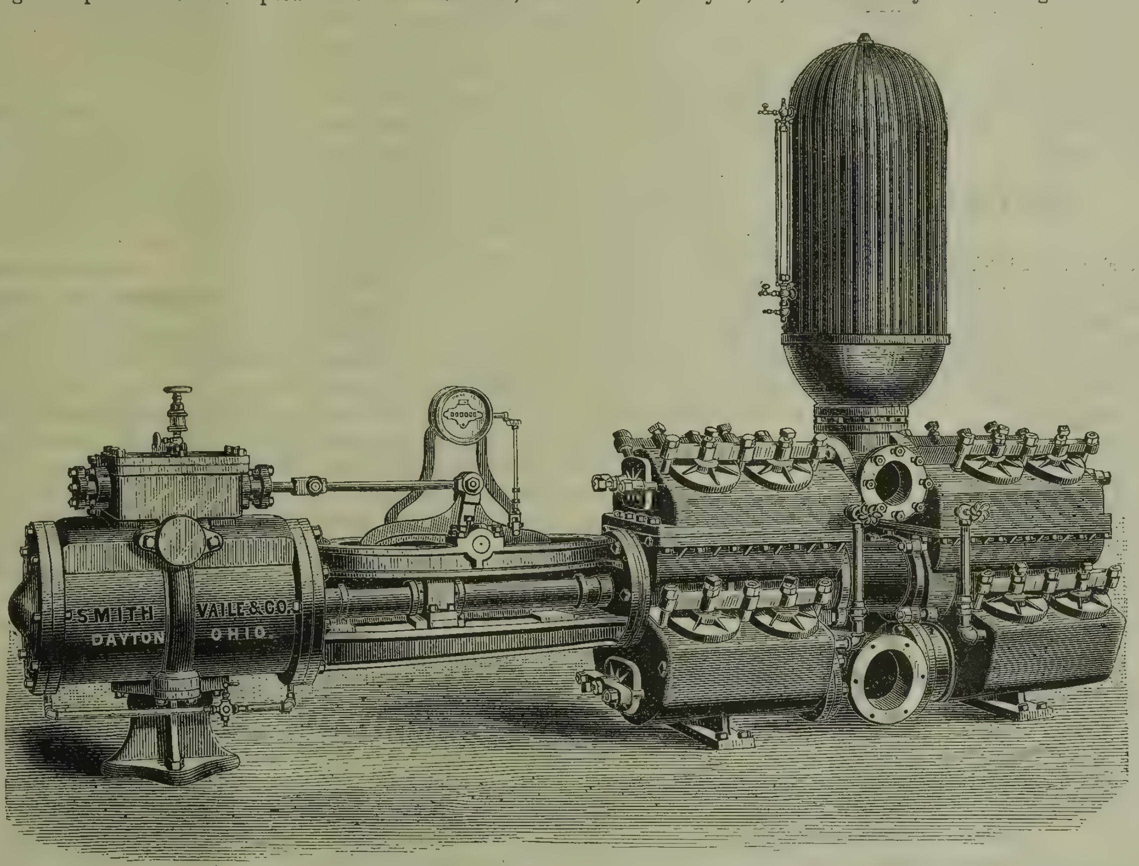
We illustrate and describe herewith a new double plunger sewerage pump which has just been built by Messrs. Smith, Vaile & Co., of Dayton, Ohio, builders of steam pumps and hydraulic machinery, for the National Soldiers' Home near that place. The machine is an exceptionally fine one, and warrants a full description. The principal points of its construction will be understood from the following:

Diameter of steam cylinder, 16½ inches; diameter of water plungers, 10 inches; length of stroke, 24 inches; capacity, 8.16 gallons per stroke. At a speed of 50 strokes per minute, which is very moderate, the pump will deliver, therefore, 408 gallons per minute. The valve motion is a new patent plain slide valve, operated by a cross-head on piston rod, and through a T lever having a curved face. The motion is perfectly positive, and the pump can be started at any point of the stroke. It can be run at high speed without pounding.

The water cylinder is double plunger in style, having stuffing boxes in the center between the two valve boxes. The suction is 8 inches diameter, and the discharge 6 inches diameter. The water valves are a feature of the pump, and have been constructed on an entirely new plan, designed to give large, free openings that will permit the passage of heavy material and extraneous matter, such as fibrous material, pieces of clothing, scraps of leather, paper, etc., and other materials of a miscellaneous nature such as may be supposed to accumulate in an institution of 4,000 inhabitants. To adapt these valves to their work, the valve openings or seats are 5 inches in diameter, and are free from cross bars or other obstruction. The valves themselves are made of rubber fastened into a cup which slides in a case fastened to or hung to the bonnets directly over the valve seats or openings. Thus, when the valves are open, they hang suspended, as it were, giving a free and unobstructed passage to the sewage.

At the National Soldiers' Home, the institution for which this pump was built, the plan in use consists in collecting all of the sewage from the various buildings and flowing it into one large cistern of sufficient capacity to contain the accumulation of several days. From this cistern it is pumped through some 5,000 feet of pipe, and from this discharged and distributed over the ground, making, as the result has shown, a most excellent fertilizer. As an evidence of this fact, it is stated that many acres of land formerly considered as almost worthless, are now raising large crops of the finest vegetables.

The pump is provided with counter, priming valves, automatic cylinder cocks, glass gauge, an air chamber, etc., and the makers confidently claim that it is beyond question the finest machine for its intended purpose ever designed and constructed. Its weight is 8 tons. Messrs. Smith, Vaile & Co., of Dayton, O., the makers of this fine machine, are specially engaged in the manufacture of steam pumps and hydraulic machinery. Among their specialties which have attained a wide celebrity, is the so-called "Dayton Cam Pump," designed and built especially for boiler feeding, for pumping hot water, pumping returns from coils and radiators of steam-heating apparatus, without the use of traps or tanks, etc.



NEW DOUBLE PLUNGER SEWERAGE PUMP.

New Theory of Steam Boiler Explosions.

The *Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Company, criticises the absurdities of some mechanical "crank," who has been delivered of a new idea, after the following humorous fashion:

"A Brooklyn (N. Y.) man has just invented, and, we presume, has patented, a bran new theory of the explosion of steam boilers, which he thus sets forth in the columns of the daily papers: 'The space above the water being filled with steam, and the pressure momentarily increasing, the central column of steam becomes inverted, and, pressing upon the surface of the water, acts like a wedge, dividing the water in the center, and pressing it against the sides of the boiler, thereby producing immense pressure at given points instead of that uniformity which the ordinary test effects. Consequently, the wedge of steam divides the water before it until the boiler is rent in pieces.' This theory is startling in its novelty, and well calculated to strike terror into the bravest heart by its terrible efficiency. Something should be done immediately. Public safety dedemands it. Somebody should immediately put a contrivance upon the market to nullify the action of the aforesaid 'wedge.' We can only offer a few suggestions. Boilers should be built without 'given points.' Then it is evident the 'wedge' would have nothing to act upon, and would probably get disgusted and leave the boiler after a short time spent in vain endeavors to get a 'grip' by which it could 'rend it in pieces.' This is an important point, and should not be overlooked. If this is not practicable, some law should be at once passed, and rigidly enforced, limiting the acuteness of the 'wedge,' or, perhaps it would be better to insist upon having it inverted, in which case it would be unable to exert any force upon the sides of the boiler, and would consequently be harmless. Or the upper part of the boiler could be filled with water, thus compeling the steam to confine its operations to the lower part.

"The inventor does not state whether a 'wedge' would be formed in this case or not. Will he please enlighten an anxious community of steam-users on this point? Or, in case we should be unable to get rid of this pestiferous and explosive 'wedge' by any means at our command, we might perhaps make use of it in some way. A boiler fitted with a new and improved system of 'wedges' of great acuteness, and consequent power, might be employed to drive the new motor invented a short time ago and described in the *Locomotive*. A combination of the 'cube of fifty inches dimensions,' with a properly regulated 'Maltese cross,' and 'cut-off bar,' with a 'yoke giving a kind of pen-

dulum motion' by means of 'cuneiform steam,' would revolutionize the steam engine business."

The Manufacturer and Builder.

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This journal has the largest circulation of any mechanical monthly published in the United States. Its value as an advertising medium is therefore apparent.

Vol. XIII. No. 12. THIRTEENTH YEAR.

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Illustrated articles are indicated by an asterisk (*).

A Word about Ourselves.

The close of another volume of the MANUFACTURER AND BUILDER, with the present number, gives us the opportunity, without violation of the modesty that always characterizes true merit, of saying a few words about ourselves. With due appreciation of the fact that "brevity is the soul of wit," we shall confine our remarks to a brief retrospect of our year's work, and to the prospects of the immediate future.

As has been our custom for a number of years, we have given our readers each month 24 pages of reading matter, illustrated with many engravings, so that the twelve numbers of the year form a finely illustrated volume of nearly 300 pages. We have spared neither care nor cost in making the MANUFACTURER AND BUILDER a model magazine in all that relates to its mechanical execution, and in this respect the handsome appearance of the journal speaks for itself.

With respect to the character of its contents, which is of more importance, we can claim, without self-laudation, that it will compare with advantage with any other journal of its class. The variety of the subjects treated of can only be properly appreciated by a glance over the index which accompanies this number. It embraces important and interesting contributions to mechanics, engineering, architecture, chemistry, physics, mineralogy, geology, sanitary science, hygiene, and, in general, about every branch of science as applied to the useful arts or to the welfare of mankind.

The department of "Notes and Queries," as heretofore, has been one of the most interesting, useful and valuable features of the journal. The reading of this department alone will afford an amount of varied information rarely met with in similar columns of other journals. This department receives, probably, more attention from the editor, and demands more time in its preparation, than any other in the journal. Recognizing its importance as the direct avenue of communication between ourselves and our readers, the editor has given it more careful attention than ever before, and has sought in his answer to each question to make it as full, explanatory and accurate as his knowledge of the subject would permit. We cordially renew our invitation to readers who desire information relating to mechanical, scientific or technical subjects, to place themselves in communication with the editor through this department.

The editorial columns of our journal during the year have been devoted, in accordance with our settled policy for years, to the presentation and discussion of themes relating to the current progress of science and the useful arts; the advocacy of various reforms and improvements which have appeared to us desirable or necessary; the correction of abuses, and the exposure and denunciation of fraud and humbug without fear or favor. Prominent among the themes discussed in this department, our readers will have noticed the subject of "Underground Telegraphy," the constant agitation and advocacy of which reform in our pages has contributed very largely to the creation of the general public interest now felt respecting it. In this department it shall be our effort in the future to add to its value.

The scientific department will be found to contain, in condensed form, an epitome of the progress of science and the arts during the year, and shall continue to receive our careful attention in its preparation. Each number has contained a new architectural design from the pencil of some one of our prominent architects, which feature will also be continued as before. The descriptions of new machinery and mechanical devices, many of which were handsomely illustrated, have added greatly to the usefulness and attractiveness of our journal, and have been found instructive and useful to the large body of our readers whose tastes are mechanical. We shall make no changes respecting this feature of the journal, save to use our best efforts to improve upon it by the most careful attention to the selection of material and illustrations. In brief, while maintaining all the features that have made the MANUFACTURER AND BUILDER a popular and successful journal, we shall use our best endeavors in the future to improve them and to keep it in the first rank among American technical journals.

As regards the business of the journal, we have the gratification of announcing that the past year has fully met our anticipations. We have had large accessions to our already large list of subscribers, and the crowded state of our advertising pages speaks for itself as to the prosperity of this branch of our business.

The business outlook for the approaching new year is in all respects hopeful and promising. There have been periods in the history of our country when there has been greater activity; but there never was a time when general business was in so satisfactory a condition, or when it was conducted upon so substantial and conservative a basis as at present. The existence of these prudential elements affords the assurance that the present prosperous condition of the country will continue, and, let us hope, for years to come.

To many of our subscribers, old and new, the close of our volume will bring the reminder that the period of their subscription has expired. As most of them are doubtless men of business, it will scarcely be necessary to say to them that some annoyance and delay in receiving future copies will be avoided by giving prompt attention to the proper renewal of their subscriptions for the next year. To those intending to subscribe, we may add that the commencement of a new volume is a convenient point to start from. To all of these friends, many of whose names have been on our books for years, and to our advertising patrons, we extend our warm thanks for their interest and patronage, and give them the assurance that we shall leave nothing undone to continue to deserve their confidence and support.

Elevators and Fire-Escapes.

During the past month the people of this city and of Philadelphia, have each had an exciting theme of discussion involving the imperilment of human life. The daily newspapers fanned the public excitement for a few days, and then, as usual, the subject was dropped. In Philadelphia the theme of discussion was "fire-escapes," and for a whole week following upon the occurrence of a terrible calamity—the burning of a mill in which a dozen lives were lost by reason of the criminal neglect of some one to provide suitable means for the escape of the operatives employed in the upper stories—scarcely anything else was talked about. In this city, by one of those coincidences, the fall of a passenger elevator in one of the hotels, furnished food for some days for much serious reflection and discussion, and gave rise to much excited talk about "man-traps."

From the unusual prominence given to the accidents above alluded to, it might reasonably be inferred by one unacquainted with the real state of the facts, that inefficient fire-escapes to factory buildings, and dangerous passenger elevators, were things of remarkably rare occurrence. How far such an opinion is from the truth, our readers do not need to be informed. Not a day passes that the newspapers of some section of the country do not convey the intelligence of some disaster from one or the other of these causes, involving loss of life or serious injuries to person. It is only when an accident from these causes occurs under circumstances that lend unusual prominence to it, as, for example, the fall of a passenger elevator with its human freight, which occurred recently in one of the hotels of New York; or the burning of a factory building crowded with operatives, to escape from which scores of the terrified prisoners—many of them helpless women and children—cast themselves down from the upper stories upon the pavement forty or fifty feet below, which occurred a few weeks ago in Philadelphia, that public attention is specially attracted and the newspapers thunder forth their denunciations and call loudly for the more efficient protection of human life. The coroner's inquest brings out all the sickening details of the tragedy, and for a few

days public indignation is maintained at fever heat. The necessity of "doing something" is loudly urged, and to appease the public clamor, perhaps an investigating committee is appointed to find out who was to blame, and to suggest some reform; and as the topic drops out of public sight, the temperature of the patient creatures' pulse falls again to normal, and the circumstance and the reform are quietly strangled in the meshes of red tape.

This farcial procedure has been repeated so often, that we have almost despaired of seeing any really effective measures taken to protect human life against the special forms of danger here spoken of.

From a strictly technical or mechanical standpoint, the problem of devising an elevator that shall be absolutely safe, and a fire-escape that shall under all circumstances afford a safe mode of exit from a burning building, is not so difficult of solution as might be supposed from the formidable list of accidents that are chargeable to them. On the contrary, we speak advisedly when we say that there is no excuse for accidents from either of these causes. Elevators have been devised, and many are now in use, of which it can safely be asserted that the circumstances, or combination of circumstances, that would cause them to endanger human life, are so extraordinary that they may be considered as safe as anything that human ingenuity and foresight can provide. Were such elevators in universal use, accidents from the use of these indispensable conveniences would be unknown. To secure the universal adoption of such elevators is a matter of extreme difficulty. We hear some reader say, "If there are elevators of this kind, so much safer than others, their own merits must sooner or later force their general adoption." This is substantially true, and this very process is going on now. But how long will it take by this process to do away with the thousands of "man-traps" that are in use all over the country? The owner of a building is not, as a rule, expert enough in mechanics to be able to decide upon the merits of this class of apparatus, and in selecting one of these contrivances he is apt to be guided as much by the consideration of cost and the representations of the seller as anything else. Having an elevator already in, so long as it works all right and does not drop at the wrong time, he is very apt to consider it entirely safe, the more so, because to take it out and put in another means money out of his pocket.

It is very obvious, therefore, that to let the elevator problem work itself out, on the principle of the "survival of the fittest," is a slow and unsatisfactory process. We are aware that we are treading on dangerous ground when we assume the position that it is the duty of the authorities to institute and enforce the reform in this matter; the constant imperilment of human life by the use of apparatus that have come to be looked upon as necessities in every building of any pretension, is surely a consideration of such exalted importance that none will be found to seriously question it. As to the manner of instituting this reform, it does not appear to us to be very difficult. A commission of competent mechanical engineers, selected because of their knowledge and ability, could safely be entrusted by the authorities of the city, *not* to condemn the elevators of this or that maker, but to define the elements which a safe elevator must necessarily possess, and to lay down the principles in accordance with which such appliances should be constructed. The definition of a body so composed could safely be taken as the basis upon which to frame an ordinance, which, if properly enforced by the rigid inspection on the part of duly constituted officers, of all existing apparatus, the condemnation and removal of all that were not in conformity with its provisions, and the careful examination of the plan of every new apparatus before the privilege of its erection be granted, would solve the problem for this locality at least; and our example would speedily be followed in all substantial points by other cities. It is true that this mode of treating the subject would work hardship to many owners of buildings in which expensive but dangerous appliances of this kind are already introduced, and to the makers of defective and dangerous apparatus; but grave disorders demand heroic remedies, and the method here proposed appears to us to be the only one that can effectively deal with the elevator question.

With respect to the question of fire-escapes, we advocate the same method of deciding upon some uniform set of rules and principles that should govern their construction and erection in all cases, on the basis of an ordinance that shall define what classes of buildings should be so protected, and a general system of these life-saving devices to which all must conform. We are especially gratified to observe that the horrible calamity that lately occurred in Philadelphia, to which we have alluded in the outset of this article, has at length aroused the authorities of that city to a realization that something more is required to be done than going through the motions of an investigation. And what is more to the point, they have taken the way that seems to us to be the very best they could have chosen to make provision against the recurrence of such horrible affairs. The Councils of our neighbor city took the very sensible course of appealing to the old and highly honored Franklin Institute for advice and aid. The Institute was requested, in the interest of the citizens of Philadelphia, to investigate the subject of the construction of such life-saving apparatus, and to recommend to the Councils the general plan that should in all cases be followed in their erection. This appeal was acted on by the institute, and a committee of prominent engineers from its membership were appointed to take the subject into consideration. The committee have fulfilled its appointed task with much credit, and have reported to the Councils a body of recommendations which will undoubtedly be approved and embodied in a set of ordinances on the subject. These ordinances, rigidly enforced, will render the recurrence of the late mill horror impossible. This is the only rational plan of treating such important subjects as the construction of elevators and fire-escapes. To delay action upon such subjects is simply trifling with human life.

Improved Method of Heating and Lighting Cities.

The introduction of electric lighting, both for buildings and for the illumination of the streets of cities, has made a very decided advance during the present year. There is now scarcely a prominent public building, hotel, manufacturing or business establishment into which the electric light has not found its way, and from being an exceptional or unusual circumstance to see the electric light in use, it has become so common that it no longer attracts notice or comment. The illumination of the streets of cities and towns is the next field in which the utility of the electric light will be tested. Already many experiments have been made with various forms of the electric light, with results in respect to the character of the light and its cost, that are very encouraging to the friends of electric lighting. In European cities especially, more has been done in this direction than with us, and they are considerably in advance of us on the other side of the Atlantic in this highly desirable application of the new mode of lighting. It is probable, however, that this seeming want of enterprise on the part of our city magnates is more apparent than real, and that so soon as we are fairly started in this direction, we shall make up for lost time. Meantime, while we have manifested no very lively interest in the subject of street lighting by electricity up to the present time, it is probable that we have lost nothing, for we shall have the advantage of the experience gained abroad, and be able to avoid many of the expensive failures of those who have preceded us.

At present the most interesting experiments in electric lighting in progress in this country, are those of the Edison Electric Light Company, which is now engaged, by permission of the city authorities, in laying down a complete system of conductors in the streets on the east side of New York, for the purpose of introducing the Edison system of domestic lighting by incandescence; while in Philadelphia the Brush company, representing one of the most successful of the voltaic-arc systems of electric lighting, is about ready to light Chestnut street, one of the principal business thoroughfares of that city, with its lamps, from the Delaware to the Schuylkill rivers, a distance of over two miles. This experiment, which will most probably be in operation by the time this article appears, will be watched with great interest, as it is probably the most important and extensive trial of electric lighting for public service yet attempted in this country.

Another highly interesting experiment, involving an improved method of distributing heat from a central source of supply, is likewise in course of completion in this city. We refer here to the experiment of the New York Steam Company, which is now employed in laying down on the west side a system of pipes for the general distribution of steam for the purpose of supplying heat and power. The immediate scene of the operations of this company is on Greenwich street; and an immense boiler-house, or central station, from which the steam generated from 64 boilers, aggregating in all 15,000 horse-power, will be distributed through the mains and service pipe now being laid. The system is based upon the inventions of Mr. B. Holly, as improved by Mr. C. E. Emery, the engineer of the company; and from its novelty and boldness will probably attract more general interest even than the electric lighting experiments above referred to.

We shall take occasion to lay before our readers at the proper time, our views of the merits of these experiments, so soon as a correct estimate of their value can be formed, which will be after they have been put to the test of a practical trial for a reasonable period of time.

Pasteur's Recent Investigations.

Although not strictly in line with the subjects usually treated of in the MANUFACTURER AND BUILDER, we cannot refrain from making allusion to the recent highly important investigations of the eminent French scientist, Pasteur, respecting the nature and the mode of checking certain contagious and very fatal diseases among domestic animals. These investigations give promise of being of the most superlative importance to agriculturists in the saving of many millions of dollars annually, and they have opened an entirely new field of research that may soon work an entire revolution in our methods of combatting many virulent and fatal diseases to which mankind are subject, and which thus far it has been found impossible to control.

Pasteur's name is already famous for his contributions to the study and development of the germ theory of epidemic diseases, and for his eminent services to the silk culturists, wine-growers and brewers of France, but his recent investigations, by reason of their great practical utility, promise to completely eclipse his earlier scientific triumphs.

Pasteur's latest investigations resulted in the important discovery that it was possible to take the virus of certain fatal diseases among fowls and other domestic animals, and, by subjecting it to certain processes, to so mitigate or tone down its virulence, that when introduced into the bodies of healthy animals it produced only a comparatively slight form of the disease, and that after such inoculation the animals were proof against the disease. The discovery of Pasteur, it will be noticed from this, is of the same nature as that of Jenner with relation to small-pox, and is an invaluable extension of the principle demonstrated by the latter.

Pasteur's first practical trials of the utility of his observations were made in connection with the very fatal disease among domestic fowls known as "chicken cholera," and proved highly successful. From this he has gone further, and has demonstrated the efficacy of his methods for the protection of sheep from the ravages of one of the most malignant and fatal diseases to which these animals are subject. This disease prevails

extensively among the flocks of nearly all European countries, and is known variously by the names "splenic fever," "anthrox," "charbon," and "carbuncular diseases." The disease is highly contagious, and is invariably fatal, its malignity being so great that the animal attacked with it usually dies within twenty-four hours. The disease is greatly dreaded, and has again and again decimated the flocks of Europe.

In applying the results of his investigations to the checking of this virulent disease, Pasteur proceeds, as we briefly stated at the outset, by taking the virus of the disease and subjecting it to certain processes of his own to reduce its virulence—in other words, to obtain it in what may be called a "mild" form. Having secured this, he thereupon inoculates the healthy animals with the mild virus. That this procedure does actually protect the inoculated animals, precisely as vaccination protects human subjects against the small-pox, Pasteur has proved by several convincing and brilliant demonstrations. An account of one of these, which was made on a large scale before one of the leading French agricultural societies, is given below, and proves most convincingly the superlative value of the discovery. We give below the facts that have appeared concerning this remarkable test:

"Accordingly, a farm and a flock of fifty sheep having been placed at M. Pasteur's disposal, he vaccinated twenty-five of the flock (distinguished by a perforation of their ears) with the *mild* virus on the 3d of May last, and repeated the operation on the 17th of the same month. The animals all passed through a slight indisposition, but at the end of the month none of them were found to have lost either fat, appetite or liveliness. On the 31st of the month all the fifty sheep, without distinction, were inoculated with the *strongest* charbon virus, and M. Pasteur predicted that, on the following day, the twenty-five sheep inoculated for the first time would all be dead, while those protected by previous vaccination with the mild virus would be perfectly free from even slight indisposition. A large assemblage of agricultural authorities, cavalry officers and veterinary surgeons having met at the field the next afternoon (June 1st), the result was found to be exactly in accordance with M. Pasteur's predictions. At two o'clock twenty-three of the 'unprotected' sheep were dead; the twenty-fourth died within another hour and the twenty-fifth an hour afterward, but the twenty-five vaccinated sheep were all in perfectly good condition; one of them, which had been designedly inoculated with an extra dose of the poison, was slightly indisposed for a few hours, but then recovered. The twenty-five carcasses were then buried in a selected spot, with a view to the further experimental testing of the poisonous effect produced upon the grass which will grow over their graves."

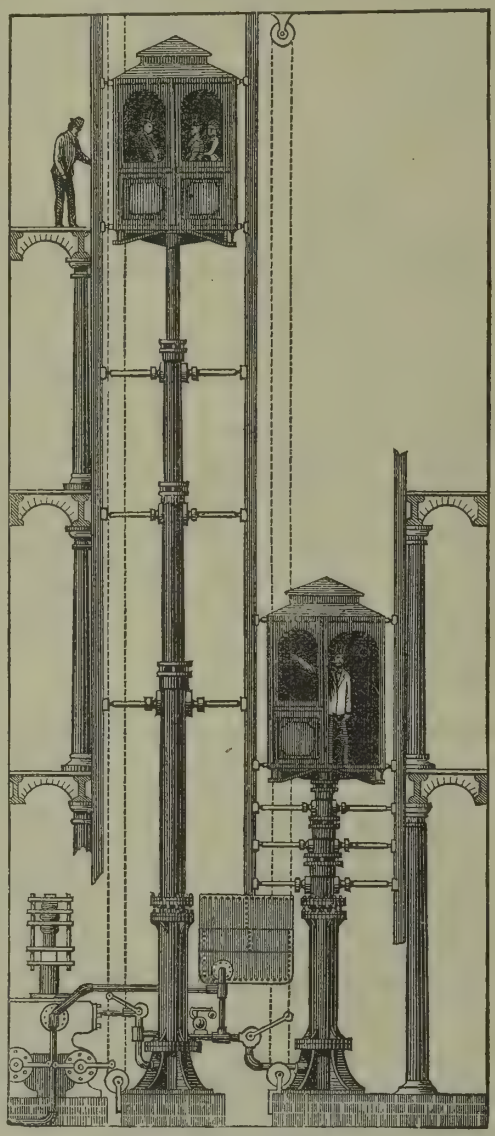
The foregoing experiment is of the most convincing character, and proves beyond a shadow of doubt the immense practical value of Pasteur's remarkable researches. It cannot, at this time, be determined how far the methods and processes of Pasteur may be capable of being extended, but it is highly probable, as it is most earnestly to be hoped, that they will be found equally efficacious in controlling the virulence of other diseases of a contagious nature, and that the same methods may be applied with success to many fatal disorders of this nature to which mankind are subject.

Awards at the Charitable Mechanic Fair in Boston.

Albert H. Emery, civil engineer, of this city, was awarded the Grand Medal of Honor for his strength-testing machine. The Whittier Machine Co., of Boston, were awarded a gold medal for steam elevators, also silver medals for a caloric engine for pumping and double screw portable hoists. B. F. Sturtevant, of Boston, received a silver medal for his steam fan, heater and blower; as did also the Curtis Regulator Co., of Boston, for steam regulators; and Arthur E. Rendle, of New York, for glass roofing.

The Eli Thayer Hydraulic Elevator.

We have lately had the opportunity of examining the construction and operation of a very simple and effective hydraulic elevator for freight and passenger uses, devised and patented by the Hon. Eli Thayer, of Worcester, Mass. This apparatus differs from the elevators in very common use in the important fact of not being suspended from cables, and raised or lowered by them, but in being raised by the direct pressure of a column of water beneath it, and caused to descend by its gradual discharge. The Thayer elevator, therefore, dispenses entirely with chains, cables, weights, counter-balances and other similar devices that are commonly employed with this class of machinery. The Thayer elevator is, in fact, a hydraulic jack, in



The Thayer Hydraulic Elevator.

construction and operation identical in principle with that familiar apparatus, and differing therefrom in certain details to adapt it to its modified application.

These modifications consist substantially in making the apparatus sectional or telescopic, where this is necessary, as in the case of high lifts, the number of sections being governed by the hight of the lift; by providing suitable guides and cross-bars for maintaining the perpendicularity of the cylinders in their ascent and descent; in providing an accumulator for storing pressure, where a number of elevators are to be operated from a single pump, in order to secure a surplus of stored water pressure and insure great ease of motion; and in other less important details.

It must be obvious to all who are in the least acquainted with the principles underlying the construction and operation of this machine, that it is characterized by one prominent feature, namely, its absolute safety. This elevator, it will be noticed, is not pulled up, as is the case with elevators commonly used, but is pushed up by the water forced into the successive sections. Its descent is regulated by the rapidity of the escape of the water from the sections, and the construction is such that this water can only escape through contracted orifices. From the ordinary forms of accidents to which elevators are liable—that is, the breaking of cables—it is of course quite free, as these are not employed. Safety catches and equivalent devices are likewise entirely dispensed with; and the machine, as witnessed in operation, is exceedingly simple in design, absolutely safe in operation, economical as to first cost and working, and very durable. A number of attempts have been made to construct elevators upon this principle, some of which have met with considerable success. It has remained, however, for Mr. Thayer to perfect the apparatus by numerous improvements in details, and to greatly lessen the cost of its construction, while in no wise detracting from its efficiency.

In the earlier elevators of this type, it was impossible to avoid a troublesome shock or jar as the successive sections reached the bottom or the top of their travel, a difficulty which was not only unpleasant to those using it, but which was also accompanied with the unfortunate consequence that it was impossible to keep the joints between the sections water-tight, and prevent constant leakage. The constant trouble from this cause amounted to an insuperable objection, and the earlier forms of this elevator were discarded chiefly on this account.

This difficulty Mr. Thayer has completely overcome by the construction of a greatly improved and highly ingenious bearing, by which the motion of the successive sections, either in rising or descending, is gradually checked and arrested, at the end of their travel, so quietly and imperceptibly that not the slightest jar or shock is experienced. The absence of this violent, concussive action enables him at the same time to effectively pack the joints with a simple packing that gives no trouble from leakage, and which can easily be replaced or renewed when desired. Without the assistance of a diagram it would be impossible to intelligently describe this ingenious provision. It must, therefore, suffice to state that it fully answers its intended purpose, and contributes materially to the efficiency of the apparatus. The improved bearing here referred to, in external appearance differs from that employed in the earlier forms of this apparatus, simply in being considerably longer.

Another substantial improvement introduced by Mr. Thayer, consists in devising a simple method by which he is enabled to use the ordinary rough lap-welded tubes for his cylinders, without the necessity of turning or trueing them, which has heretofore been found necessary in order to secure a liquid-tight joint at the bearings. The necessity of turning and trueing these pipes has been one of the most expensive items in connection with this form of apparatus; and this Mr. Thayer has succeeded in avoiding by the ingenious artifice of coating the exterior of the rough tubes, just as they come from the mill, with an elastic cement or mastic composed substantially of a mixture of beeswax and plumbago. This simple application forms a smooth surface for the exterior of the tubes, insures a thoroughly liquid-tight joint, and at the same time protects the iron against oxidation from constant contact with water.

The plant for one of these elevators usually consists of a pump (where the lift is high and the pressure of the ordinary water supply is insufficient), a water tank of sufficient dimensions to supply the apparatus, located either on the ground floor or in the upper portion of the building; the elevator proper, with its framework, guide arms, platform or car, and the necessary pipes, and valves for controlling the entrance or exit of the water to the plungers, and consequently the ascent or descent of the elevator. In many instances it will be highly desirable, on the score of convenience and economy, to run a number of elevators from one central source of power. In this case, a pressure accumulator is interposed between the pump and the eleva-

Western Electrician.

Electrician Publishing Company,

6 Lakeside Building,

Chicago,

Illinois, U. S. A.

tor pipes, to insure uniformity of motion. The accumulator serves, therefore, as a reservoir of stored pressure, and the action of the set of elevators is rendered more uniform.

Our illustration shows two of the Thayer telescopic elevators operated from one pump, one being at the top of its lift, with all the sections fully extended, and the other at the bottom of its run, with the sections telescoped. As will be seen by inspection, there are no supports, such as cables, etc., above the car. In starting the elevator, the operator moves an iron rod that serves as a lever to open communication between the pump and the base of the elevator. The water enters, therefore, at the bottom, and in so doing acts on the cap which closes the bottom of the first section, and forces this section to rise; when it has almost reached its full extension, it is gradually and quietly brought to rest by the device before mentioned, and the water enters the space between it and the second section through an orifice in the form of a conical tubular projection on its lower end; and the second section is in turn raised, and so on until the elevator has reached the top of its travel and all the sections are extended. In descending, the lever is moved in the opposite direction, so as to shut off communication between the pump and the elevator, and the latter descends by its own weight, forcing the water through a series of contracted orifices back again into the tank. The rapidity of ascent may be controlled to any desired extent by increasing the water pressure, and the rapidity of descent by the regulation of a throttling valve in the escape pipe, through which the water returns to the tank. The valve is of the three-way pattern, so that the ascent, descent and stoppage at any story are accomplished by the proper movement of the same lever.

From the foregoing description, we feel satisfied, that, so far as human prevision can extend, these elevators are perfectly safe. The only accident that could happen that could be attributed to the apparatus, might be the cracking of one of the pipes, which would let the water out of that section; but the car could not descend any faster than the water could escape from the crack. The possibility of such an accident, however, is rendered almost infinitely small by employing a large factor of safety in the tubes, by giving them a strength greatly in excess of any demand that could be put upon them. The tubes used in these elevators are all tested by hydraulic pressure at the mill to a strain of 1,700 pounds per square inch, and the greatest pressure to which they are subjected in practice will never exceed 300 pounds.

These elevators have only lately been brought before the public, but in this brief period they have gained an excellent reputation. They have already been largely introduced in our Eastern cities, and are gradually finding their way into general use elsewhere as their undoubted merits become known. Twenty-eight Thayer elevators have been erected in the new and extensive passenger and freight depot of the Pennsylvania Railroad Co., at Fifteenth and Market streets, Philadelphia, a fact that, of itself, affords the best testimony to their excellence. These are all actuated from a single pump, through the intermediation of an accumulator in the manner before described. The majority of them are designed for handling freight for a short lift or drop of one story, and these have been in use with entire satisfaction since last May. Several of them are arranged for baggage and passenger service, the latter having a lift of some 60 feet. (Since writing the above, we have been informed that the same company have ordered fourteen more of these elevators, making forty-two in all). One of the most powerful of these appliances has been introduced into the extensive woolen mills of James Smith & Co., in the same city. This elevator has a lift of 92 feet, and has afforded an excellent opportunity of testing the perfection of detail in respect to the operation of a large number of sections.

We would only add in conclusion, that we regard the Thayer elevator as an apparatus characterized by great simplicity of design, solidity of construction, very moderate first cost, efficiency in service, and preeminent safety.

The Atlanta Fair.

The daily papers are still full of accounts concerning the extent and admirable character of the exhibits displayed in the great cotton exhibition at Atlanta, Ga., and with one accord agree in pronouncing it to be the most complete and instructive display of textile materials, fabrics and machinery ever displayed in this country. The only unfortunate circumstance that threatened to imperil the success of the exhibition, from a financial standpoint, was at the outset the mistake of the various railroad and other transportation companies in keeping up their rates of fare to what amounted almost to a prohibitory basis for those living at a distance from Atlanta. This mistake, through the energetic protests of the exhibition officials, has now fortunately been measurably corrected, with the result of bringing about an immediate and marked improvement in the attendance.

All accounts of the exhibition unite in praise of the variety and magnitude of the exhibits therein displayed. The main building, covering many acres of space, is crowded with machinery and exhibits, relating chiefly, of course, to the textile industries. The main interest centers, however, in the display of cotton and cotton products, concerning which it is asserted that there is scarcely a single process known in the manufacture of this staple that is not shown there. The display of raw cotton by Mr. S. M. Inman has received unqualified praise. It embraces bales from Egypt and other sections of Africa, Zuerna, Persia, India, China, including the brown or Nankin cottons of Nankin, Japanese cottons, West Indian and Brazilian, Mexican, Peruvian, Siamese, Bengalese, and many other foreign cottons, besides the greatest variety of the domestic raw product. In a portion of the grounds there is an enclosure within which there is shown growing the cotton plant from all quarters of the globe. The field is said to be a marvel of agriculture. It is an enclosure of a very few acres, where, growing side by side, can be seen every variety of cotton plant that can be grown upon the earth. There is cotton from India, from Hindostan, from China, from Japan, from Australia, the north coast of Africa, Brazil, Chili and the South Sea Islands, the Cape of Good Hope, Mexico, Central America, Bombay, and every other climate in which the cotton plant has ever been grown. Each plant preserves its characteristics admirably; and side by side may be seen cotton with the perfectly red flower growing ten feet high, and the stalks with perfectly blue flowers growing less than two feet high. There is the queer Chinese cotton, with a pinched, contracted look that marks everything that comes from that country; the Peruvian cotton, with its flowers of indigo and its small bolls; the Indian cotton, with its tropical cotton but imperfect fruitage; and all of them, with their various marks, crowned by a few rows of our own—king of them all. The collection of seed for this field was a matter of great painstaking and expense.

Of the great variety of machines to be seen in operation, the more important are looms, gins, cleaners, carders, combers, lappers, openers, etc. A preliminary trial of the cotton gins was had last month. The cotton for the test was selected from a single field. Each competitor was furnished 100 pounds. The time of each was taken, and the fiber and seed weighed after ginning. Each lot of lint was picked separately, and all the parcels will be sent to Boston for inspection at the next meeting of the New England Cotton Manufacturers' Association. A large delegation of spinners attended the competition, and it is expected that several important questions will be settled by it.

As an indication of the importance attached to the exhibition by the representative Northern manufacturers, the following statement, furnished to the press by Messrs. Atkinson and Garzeed in behalf of the National Cotton Manufacturers' Association, will bear testimony:

"The first committee of the New England cotton manufacturers and their friends have separated, most of them going home. They concur in this opinion, that the meeting of the National Cotton Planters' Association, to be held in December, three to six hundred in number, should be met by an equal number of manufacturers from the North. They affirm that if this can be brought about, it alone will fully justify the Cotton Exposition. They have found that the tools and machinery for planting and preparing cotton for the spinner are of the utmost importance to both the grower and the spinner. They have found an exhibition of cotton machinery such as has never before been brought together in this country or elsewhere. They have found in the annex buildings evidence of the natural resources of this Southern section, in agriculture, in commerce, in minerals and in timber, which could not be equaled from any other equal area of the earth's surface; and in the use to which these resources will shortly be applied, they find promise of a vastly greater number of customers for their own mills than they expect to find competitors in Southern mills. They have met the Southern manufacturers with a hearty good will and earnest wish for their success. They concur unanimously in the judgment that there are greater promises of improvement in many directions, but especially in the handling of cotton, which would emanate from this exhibition than from any one ever before held. They earnestly hope that crowds from the North will meet the crowds from the South, that the beneficent influence of the meeting may extend beyond material interests and work a common good for our common country."

The actual benefits of this great exhibition will not be at first fully appreciated, but there can be no doubt that by giving the keen, enterprising capitalists of the North the opportunity of properly estimating the resources of the South at their true value, it will be the means of bringing about the introduction into that section of the capital and mechanical skill of which the South has long stood in need.

The following manufacturers make creditable displays: The H. W. Johns Manufacturing Co., of this city, exhibit liquid paints and asbestos in various forms. The Delameter Iron Works, of this city, exhibit their steam pumps and the Ericsson hot-air engine. The new pulsometer is exhibited in operation by the Pulsometer Steam Pump Co., of this city. The Stilwell & Bierce Manufacturing Co., of Dayton, O., show the Eclipse double turbine water-wheel, and Stilwell's patent lime extracting feed-water heater and filter. James Leffel & Co., of Springfield, O., exhibit the Bookwalter semi-portable engine and boiler, and the Leffel turbine water-wheel. The Willimantic Company are using an 8 horse-power engine of the New York Safety Steam Power Co., of this city, to run their machinery at the exposition. Goodell & Waters, of Philadelphia, exhibit a fine line of wood-working machinery. The water-tube boilers of the Babcock & Wilcox Co., of this city, supply the motive power for the exhibition.

Pressure of Wind in Storms.

Mr. C. Shaler Smith has applied the results of the observations of several years to the estimation of the amount of pressure that has been exercised by the wind in gusts of extraordinary violence. The most violent storm of which he has a record occurred at East St. Louis, Ill., in 1871, when a locomotive was blown over by a wind pressure of 93 pounds per square foot. The jail at St. Charles, Mo., was destroyed in 1877 by a pressure of 84.3 pounds per square foot; a brick dwelling at Marshfield, Mo., in 1880, by a force of 58 pounds per square foot. Railway trains may be blown from the track, and bridges prostrated by pressures of from 24 to 31 pounds per square foot. These estimates are based upon the calculation of the smallest amount of pressure that would do the damage.

The Hartford Automatic Engine.

Our illustrations represent a newly designed automatic engine, built by the Hartford Engineering Co., of Hartford, Conn. The new engine is substantially a re-design, based upon the well-known Buckeye or Thompson system of valve-gear, but embracing a number of material improvements upon its prototype, which have been suggested by experience gained in the practical operation of the Buckeye engine. This engine, especially since the time of the Centennial Exhibition, has gained a remarkable popularity and an extensive sale in the Eastern market. The company above named have undertaken the manufacture of a new engine of this type, in which, while it embodies the special principles that have made the Buckeye engine so successful, they have sought to incorporate all the improvements that skill and experience could suggest. The result of their careful study and labor is shown in the Hartford Automatic Engine, the chief characteristics of which appear in the accompanying illustrations, and will be understood from the following description.

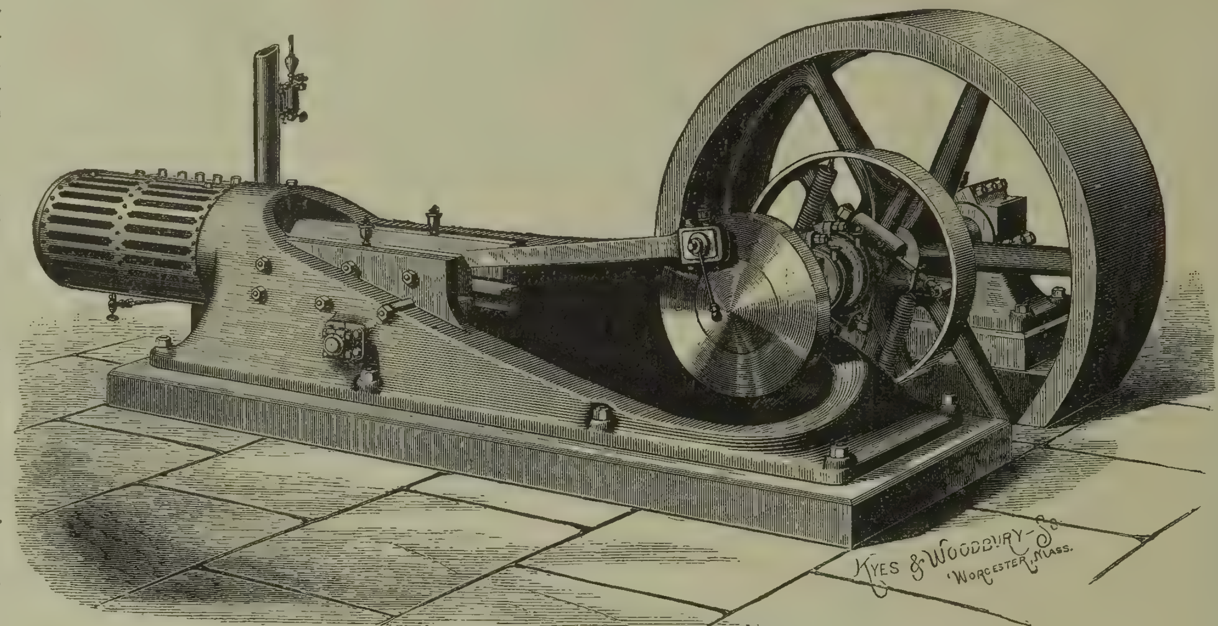


Fig. 1.—HARTFORD AUTOMATIC ENGINE—FRONT VIEW.

Figs. 1 and 2 of our illustrations represent respectively a front and back view of the new engine, and Fig. 3 a horizontal section through the cylinder and valves. Referring to the perspective views, Figs. 1 and 2, a very noticeable feature is the extremely massive bed, which is a point of prime importance in the design of engines intended to be run at high speed. In addition to its massiveness, it has a broad bearing surface on the foundation, and a large amount of metal kept above the "load line," or center line of the engine, by which distribution the strains from cylinder to bearing are transmitted in a straight line. The portion of the bed to which the cylinder is attached is strengthened by a massive hood, and additional rigidity is obtained by a heavy rib down the front of the bed. The main bearing is heavily buttressed, and the inside of the bed is hollowed, to catch any drip of oil.

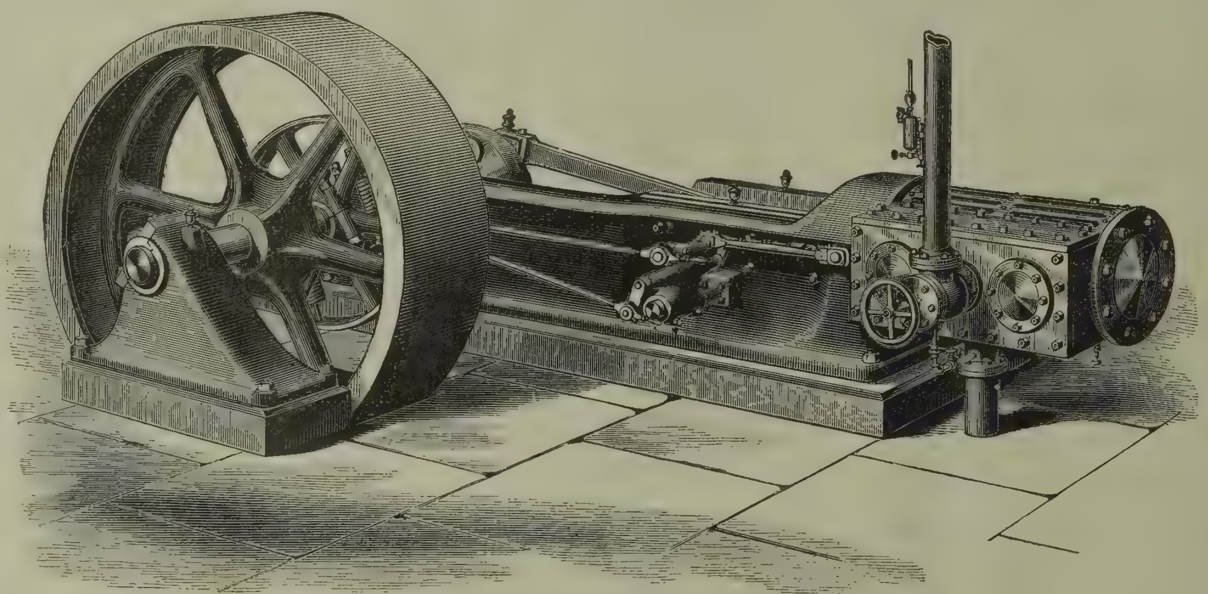


Fig. 2.—HARTFORD AUTOMATIC ENGINE—BACK VIEW.

Referring now to the valve motion, with special reference to Fig. 3, the live steam enters at A, whence it passes through passages *a* and the open passages D into the interior of box slide valve B B, following the direction indicated by the arrows. From the box valve the steam is admitted to the cylinder through ports *b b*, in its face, as these are alternately brought into coincidence with the cylinder ports.

The cut-off valve, consisting of two light plates C C, connected by rods C′, works on seats inside of the main valve, as seen in the engraving, and alternately covers the ports leading to the cylinder. The cut-off valve stem *g* works through the hollow stem G of the main valve. The exhaust takes place at the end of the valve (shown by the arrow on the right) into the valve chest, and thence into the exhaust pipe F below.

Among the new features of this engine, are the relief chambers *e e*, in the valve seat. The use of these will be understood from the explanation that the steam being inside of the slide valve instead of around it, as with the common slide valve, the tendency of the pressure of the steam in the ports *b b*, and cylinder, is to force the valve from its seat. This tendency is counteracted by the pressure of the entering steam, this pressure being proportioned to the area of the pistons or equilibrium rings D. These pistons are made large enough to hold the valve to its seat at the moment of admission (see left end of valve), when the tendency of the valve to leave its seat is greatest, being then equal to the pressure of the steam on the united area of both the port *b* in the valve and the port in the cylinder. At other times, the pressure on the seat would be greater than necessary, to prevent which the relief chambers *e e* are provided, to which live steam is admitted through the small holes *f f* in the face of the valve, first after it is exhausted from the cylinder, as shown at the right hand end of the valve, and in turn exhausted from them, as shown at the left, just before steam is admitted to the cylinder. The result is a moderate and very nearly uniform pressure on the seats at all points of travel. Two loose gland rings *h h* are carried in the main stuffing box. These fit the rod, but are loose in the box. The cylinder head and follower are bored larger than the rod, which can thus be properly packed, and at the same time have sufficient lateral play in case of defective alignment.

It should be explained that the interposition of the equilibrium rings on its back, as described in what has preceded, affords a very practical method of balancing the valve. These rings are so proportioned as to take off about 85 per cent of the full pressure, which is as much as is practicable to avoid blowing or leaving the seat.

The engine can be run with the cover of the chest removed, and any leakage of the valve detected and located. The makers take advantage of this fact to fit the valves tight in the first instance, which they accomplish by working them in the shop under 80 or 90 pounds steam pressure, and repeatedly scraping them until all leakage has disappeared, and it enables the engineer to inspect their condition at any subsequent time.

This feature of the valves, their flat wearing surfaces, and their constant travel in reference to the cylinder and to each other, which is brought about by the compound rock shaft, give them a tendency to increasing tightness by continued use. Again, the valve motion being positive, the speed of the engine is unlimited in this respect, and there being but two ports in the cylinder, the liability to loss from leakage is diminished, and the clearance, by reason of the close proximity of the valve to the bore of the cylinder, and of the cut-off to the main face, is reduced to a minimum, it being from 1 to 2 per cent of piston displacement.

The piston P is made as light as consistent with strength, and is permanently fixed on the rod. It has a long bearing in the cylinder, its thickness being always one half of its diameter, and it is packed with two simple spring rings which require no adjustment.

The cross-head is fitted with a steel pin and gun metal shoes, and is split and finished in such a way

that when bolted together it binds so tightly on the thread of the rod as to require no jam nut, while at the same time it can be readily loosened to admit of adjusting the length. Both guides are adjustable for lining the cross-head. The connecting rod is flat and tapering, increasing gradually in area of cross section from the cross-head to the crank-pin end. The crank end is fitted up with a solid head, and the boxes are of the hardest gun metal, faced completely across with babbitt. They are taken up by a wedge and screws, which form a solid backing and at the same time admit of nice adjustment. The cross-head boxes are of gun metal without the babbitt.

The shaft and crank pin are unusually large. The diameter of the shaft is always one-half the bore of the cylinder, and the length of the bearing equals the bore. The shafts are of best hammered scrap. The crank pin is of steel and ground true on dead centers, its diameter and its length both being three-10ths of the bore of the cylinder. The cross-head pin is also of steel. A counter-balance disk crank is used on all sizes.

All bearings are provided with two means of lubrication—the one automatic, and answering all ordinary purposes, while the other is positive, and is for use in case of the choking or clogging of the automatic devices. Throughout there are ample and simple means of adjustment and compensation for wear.

The company make the claim that in respect to design, material and workmanship of their engine they have spared nothing to render it a typical representative of the best practice of to-day. They contemplate in their construction moderately high speed—100 to 200 revolutions, according to size; steam pressure of from 80 to 90 pounds, and fairly heavy loads corresponding to a cut-off at about one-quarter stroke.

William Lee Church and George A. Barnard are the engineers of the company, and Harris Tabor is general superintendent. We have necessarily been obliged, owing to the large encroachment upon our space that it would entail, to omit reference to many interesting details in the construction of these admirable engines, and to pass by others with very brief mention. Those of our readers who desire such additional detailed information as we have been unable to give, may readily obtain the same on application to the office of the Hartford Engineering Co., at Hartford Conn., or at their New York offices, Rooms 72 and 73 Astor House.

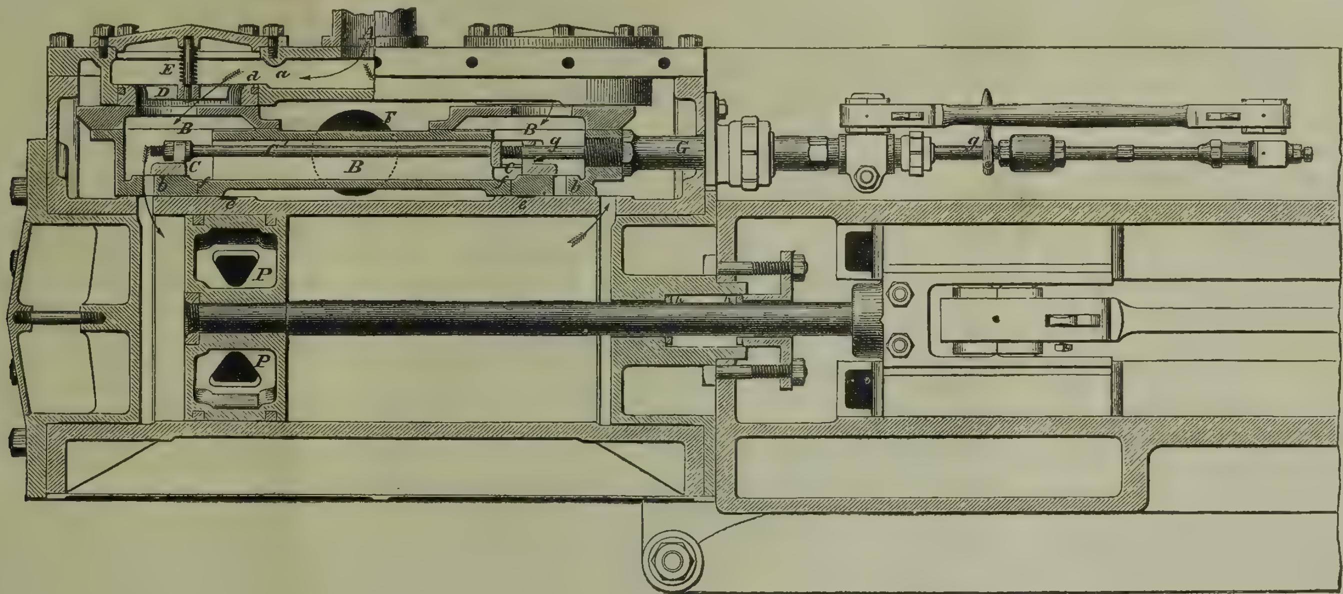


Fig. 1.—HORIZONTAL SECTION OF CYLINDER AND VALVES.

POSTAL STATISTICS.—The annual report of the Superintendent of the Free Delivery Division of the Post Office Department for the year ended June 30, shows that during the year there were delivered 262,425,668 mail letters, 59,968,559 mail postal cards, 76,733,208 local letters, 43,898,158 local postal cards, 2,126,309 registered letters, and 146,417,114 newspapers. There were collected at the 109 free delivery offices during the year 284,759,945 letters, 85,793,125 postal cards, and 54,075,476 newspapers. The cost of the service for the year amounted to $2,493,972,14, or 3 mills a piece.

Ignorance Regarding Machinery.

The general ignorance regarding machinery is surprising, when it is considered that machines, in some form or another, enter so largely into the economies of our daily life. Newspaper men are especially open to this charge of ignorance, which in their case is less excusable, as they are expected to "know something about everything." When such mechanical appliances and chemical operations are combined as in the experiments of Edison, perhaps a lack of definite knowledge may be overlooked, for only a comparatively few specialists are *au fait* on electricity. But the steam engine—its office and work, and its prominent parts—has been a common possession for generations; and the ordinary tools of the mechanic—the lathe, planer, screw-cutting machines, and other common appliances—are to be seen everywhere, and ought to be familiar to all. Yet the newspaper notices of machinery and tools are seldom correct unless written by a practical mechanic, and sometimes are laughable from their absurdity. A short time ago, in a notice of a derailment of a locomotive by the breaking of a connecting bar between the drivers, it was stated that the piston rod broke, and the end, falling to the ground, lifted the engine from the track! Another account told of the breaking of "the crank of a truck." Latterly we had an account of the "explosion of a steamboat's chimney," and "explosions of engines" are frequently mentioned. The bursting of a fly-wheel by the breaking of the governor belt, which stopped it, and allowed the full pressure from the boiler to enter the cylinder unchecked, was accounted for by the too rapid velocity of the governor. The collapse of a flue was called the "bursting of a crown sheet," and the worst explosion of all was the "explosion of a rivet." A notice was recently made of the cracking of the walking-beam of a large engine, and the statement was made that the works would stop until a new shaft could be cast. A notice of a new marine engine stated that the piston rod ran in ball-thrust bearings—alluding probably to the thrust bearing of the propeller shaft! A description of a large boring lathe conveyed the information that the live cone ran in "rabbeted boxes"—meaning, evidently, that the live or head arbor ran in Babbitt metal boxes. A new planer was described as having "ways that run on V frames"; and a machine to make screws from bars was credited with "threading the heads of the screws," and that process was described as done *after* the screw was cut off the bar. "A solution of bicarbonate of soda" was employed on the screw-cutting tool.

These inaccuracies are in some cases inexcusable, but in most a superficial knowledge of a machine, or a smattering of natural philosophy found in common school text-books, would have prevented errors so egregious as to raise the laugh of ridicule.

The "City of Rome."

The City of Rome, the new steamship of the Inman line, reached this port on the 25th of October, after her first trip across the ocean. The passage was made under very unfavorable circumstances with respect to the weather, encountering terrific gales throughout the trip. She made the passage between Queenstown and this port in eight days and twenty-two hours, but her owners say this trip is no criterion, as her machinery is not yet in perfect working order, and she was only put to three-quarters speed in consequence of the gales. The City of Rome brought 280 saloon passengers and 1,156 in the steerage. Excepting the Great Eastern, she is the largest steamship afloat. She is 546 feet long. Her displacement, at 26 feet mean draught, is 13,500 tons, so that she has a dead-weight carrying power of 5,500 tons. The cubical contents of her hold give her a measurement capacity of 7,720 tons, at 50 cubic feet to the ton. Her stern frame or post is the largest single forging ever made for such a purpose, the finished weight being estimated to be not less than 33 tons.

Spontaneous Combustion in Process of Drying.

A recent fire on the premises of William S. Slater in Rhode Island, which did some injury to his mills, brings into conspicuous notice the spontaneous combustion of yarn dyed certain colors, while not fully recovered from the operation of the dry-room. The statement is made by Edward Atkinson that during the past four years the several mutual companies of New England have suffered a loss of more than $300,000 from spontaneous combustion of dyed cotton goods in dry houses or finishing departments. Some heavy losses have occurred from this cause where aniline, cutch, logwood, iron and other common substances have been used for dyeing, without the use of oil of any kind. There are several colors produced in calico print works and dye-houses which are sources of danger from combustion. They are the colors developed, after the materials have been applied to the cloth or yarn, by chemical reactions in the tissues, with the production of heat, and also by the aid of heat applied to the fabrics in the aging boxes and chambers. Spontaneous combustion in black, brown, slate and pearl

dyed woven fabrics and yarn is frequent. The conditions under which fires have occurred, seem to have been where cloth or yarn recently dyed or dried over dyeing cans, has been rolled or piled hot or slightly damp, either of which conditions are hazardous as regards spontaneous combustion. Some time since Edward Atkinson suggested the following precautions to be observed by members of the company of which he is president: Provision should be made for a thorough cooling and drying of the fabrics before folding, rolling or piling in bunches; dyed fabrics must not be allowed to remain in compact masses in an unfinished state over night; but have them starched, cooled and finished as quickly as possible; dyed goods or yarn should not be piled in large quantities, but spread over a sufficent surface to permit them to cool readily; a suitable place of deposit, as nearly fire-proof as it can be made, should be provided for keeping goods over night that are liable to spontaneous combustion if such keeping cannot be avoided.

Building Intelligence.

Architects, Builders and Contractors are invited to send us items of interest for this department. It is our object to notice only the more important operations in building, our space being too limited for the publication of minor matters, which, besides, possess only local interest. We wish to publish only such intelligence as is of general interest.

NEW YORK CITY BUILDING ITEMS.

Julius Boekell has completed the plans for a flat house to be erected at 39 St. Marks place.

John Totten will commence at once the erection of a flat house, at 406 West Forty-seventh street, from designs by C. F. Ridder, Jr.

Mrs. Catherine Fettretch will erect a flat house from designs by D. S. McKrae, at 113 West One Hundred and Twenty-fourth street.

On the north side of Seventy-eighth street, 250 west of Ninth avenue, Ferd. Hemmerling proposes to erect a flat house. The architect is John Brandt.

The lot of ground on Seventy-ninth street, 325 east of Third avenue, is to be improved by the erection of a flat house, by Mrs. Sarah T. McCool. Architect J. C. Burne.

The plot of ground on the south side of Seventy-eighth street 175 feet west of Ninth avenue containing two city lots, is to be improved by the erection of three private dwellings.

The buildings belonging to the Charlick estate in Thirty-fourth street, between Seventh and Eighth avenues, are to be converted into elegant flats, eight stories high, at a cost of about $200,000, from designs by Horace G. Knapp.

J. B. Squiers proposes to erect at once four and perhaps six first-class four-story brown stone dwellings on the east side of Fourth avenue, between Eighty-second and Eighty-third streets, at a cost of not less than $18,000 each.

James Renwick is engaged on plans for a new residence for Vicar-General Quinn. It is to be erected on the southwest corner of Madison avenue and Fifty-first street, and will be in the same style, but on a smaller scale, as the Cardinal's.

The block of ground bounded by Second and Third avenues and Sixty-eighth and Sixty-ninth streets, is to be improved by the erection of a row of flats with stores on either avenue, and private dwellings on the streets. The work of excavating and grading will be commenced without delay, the contract having been entered into by John D. Crimmins, and its cost will be about $100,000.

M. Braender will soon commence the erection of a large first-class apartment house on the south side of One Hundred and Fourth street, west of the Boulevard. It will be five stories high, built of brick, with brown stone trimmings, and will have a front on the street of 100 feet with a depth on either side of 80 feet. There will be a large entrance in the center, and each set of apartments will have a private hallway.

Henry Villard proposes to improve the plot of ground fronting on Madison avenue, between Fiftieth and Fifty first streets, and extending 175 feet in depth. His plan includes the erection for himself of a magnificent mansion on the southeast corner of Fiftieth street, 60 by 110 by 175 feet, the placing of a magnificent fountain and garden with a frontage of 80 feet on Madison avenue directly in the center of the block, and of a semicircular form, and in the rear a number of residences. The cost of this improvement will doubtless reach $1,000,000.

Robert H. Robertson has just completed the plans for the new Madison avenue Methodist Episcopal Church, to be erected on the northeast corner of Madison avenue and Sixtieth street. It will be built in the Romanesque style, of free-stone, with a central tower 175 feet high. The Sunday School building will adjoin the church, and will be 32 by 89. The clear story of the church and the lantern of the tower will both be of terra cotta. It will have a seating capacity of 750. The first story of the Sunday school building will be used for parlors, and the upper part for school purposes. Work will be commenced on the opening of next spring, and the cost of this elegant church edifice will be $100,000.

The plans for building an extension to cover the whole lot as well as to remodel the old Moller house, on the northeast corner of Fifth avenue and Thirty-second street, are being drawn by Robert H. Robertson, for the Knickerbocker Club. The extension will be of brick with brown stone trimmings, in conformity with the main building. The first floor will be used for billiard and smoking rooms and cafe, the second for dining rooms and the third as a kitchen and servants' dining room, The club expect to expend $50,000 on this improvement to their new club house, and will commence operations as soon as Cornelius Vanderbilt vacates the premises for his new mansion further up the avenue.

A new departure in apartment houses is about to be undertaken in this city. The apartments are to be on the "home club" plan. A "home club" is an ordinary joint stock company, limited, and the holder of a certain amount of stock is entitled virtually to a perpetual lease of a certain apartment in the building erected by the company. The object is to afford the occupants not only superior accommodations, but a degree of exclusiveness not attainable in ordinary flats. There will be eight distinct buildings, designated respectively as the "Madrid," the "Cordova," the "Granada," the "Valencia," the "Lisbon," the "Barcelona," the "Salamanca," and the "Coimbra." The location of these buildings is pleasant, central, and healthful, being on Seventh ave., Fifty-eighth and Fifty-ninth sts., and facing Central Park. The buildings, each of which will be adapted for thirteen families, are placed so as to form a hollow square with a vast central court, ornamented with fountains and flowers, and so disposed that the rear of the structures will have as much light and air as the fronts of ordinary houses on the street. Lofty open arches traverse the building in every direction and allow a perfect circulation of air throughout the whole. There will be three internal courts or gardens, reserved entirely for the private use of the occupants, and into which carriages can be driven. Each house or "club," with a frontage of about 100 feet, contains thirteen apartments, three of which occupy the whole surface of the building, and the remaining 10 occupy one-half the frontage and the entire depth. It is claimed that these apartments will exceed in size, convenience, light, and ventilation anything yet built in this city. They are intended to meet the wants of that numerous class of people who, while they only need and really use some five or six rooms, are compelled to assume the care and expense of a house and establishment adapted to a family twice the size of their own. The cash investment of each club member is made comparatively small. Each club consists of thirteen members, and is organized as a joint stock company. The capital stock of each company is divided into 16 shares, and parties wishing apartments that occupy a whole floor will have to secure two shares. The maximum cost of erecting one of these buildings, all of which are to be elegantly finished and absolutely fire-proof, is about $240,000, of which $160,000 has to be raised by the associates, making each share, or the cash investment of each member, $10,000 or $20,000 for those occupying a double apartment. One of the buildings will contain a first-class restaurant from which parties desiring to do away with the cares of housekeeping can have their meals sent directly to their dining-room through the servants' elevator. The buildings will be heated by steam, lighted with both gas and a mild electric light, and supplied with water from an artesian well. Hubert, Pirsson & Co. are the architects.

MISCELLANEOUS.

Mayer & Bachmann's brewery, at Clifton, Staten Island, is being rebuilt.

A new county court house is proposed at Saginaw City, Mich., to cost between $80,000 and $100,000.

The First Universalist Society in Brooklyn, under the pastorate of the Rev. Mr. Canfield proposes the erection of a handsome church on the corner of Grand avenue and Lefferts place.

Judge Van Vorst contemplates erecting during the winter and spring a handsome villa at Nyack. It will be of stone and open timber construction, and will cost about $15,000. Horace G. Knapp is the architect.

E. L. Donnellon is about to erect a four-story brown stone flat house, with store, on the southwest corner of President and Henry streets, Brooklyn, N. Y., It will be 20 by 45, and cost about $8,000. R. Dixon is the architect.

Richard M. Hunt is drawing the plans for a handsome chapel to be erected at Princeton, N. J. It will be a present to Princeton College from Henry G. Marquand. The chapel will be built of Jersey brown stone, in the Romanesque style, and be capable of seating 800 persons. The cost will be nearly $125,000.

At Twenty-fifth and South streets, Philadelphia, the Lombard and South Street Passenger Railway Co. will build a new depot, 149 by 154 feet, of brick, consisting of administration-building, car-house and stable. The cost is to be about $30,000. Hazlehurst & Huckel are the architects.

R. Dixon is at work on the plans for three three-story brick dwellings, 20 by 40 each, and to be erected on the south side of Wyckoff street, 220 feet west of Third avenue. Brooklyn, N. Y., The owner J. H. Whooley, expects to expend about $15,000 in erecting these houses. The builder will be E. H. Whooley.

Mrs. Emma Knapp, of Deal Beach, has given a piece of property near Great Pond, N. J., to the United States Government for the erection of Life Saving Station No. 6. Work will be commenced at once, and the building will be three stories high, and contain all the modern life-saving appliances. It is said that this will be the finest station on the coast.

The plans submitted by Pugin & Walter have been adopted by the new Memorial Presbyterian Church of Brooklyn. The church will be erected on the corner of Seventh avenue and St. Johns place, and it will be in the early English Gothic style. The dimensions will be 98 by 100, including the Sunday school annex. It will be built of red granite, with a steeple dressed with Ohio stone. Cost, about $46,000.

The George T. Smith Purifier Company intend building at Jackson, Mich, a flouring mill 65 by 90 feet. It will have six stories, rising to a hight of 80 feet above the sidewalk. Machinery of the latest and most improved construction will be used. An elevator will also be built having a storage capacity of 500,000 bushels, with side track and other conveniences. The entire cost will exceed $125,000.

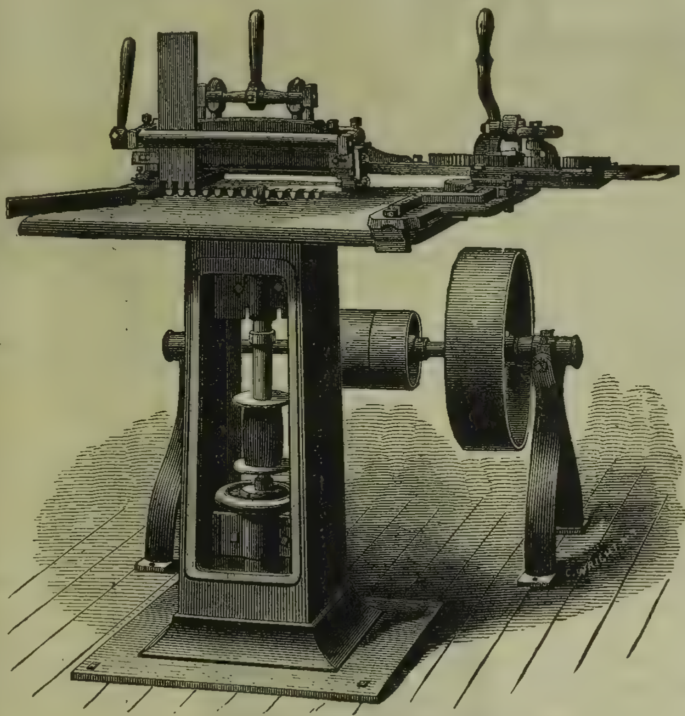
A very large business block is projected in Minneapolis, Minn. Keyes & Pardie are the architects. The building will include 15 stores, 12 of which will be four stories high, and three, five stories high. It will have a frontage of 630 feet on Nicollet avenue and Fifth and Sixth streets. The front is to be of Ohio stone. Three and one-half millions of bricks are estimated to be required for the back and fire walls and 600 perch of stone for the foundation.

Boult's Independent Dovetailer.

This machine, manufactured by the Battle Creek Machinery Co., of Battle Creek, Mich., is substantially the standard dovetailer so long and successfully used in connection with Boult's molder and paneler, but placed upon an independent frame designed for its use. By thus making it an independent machine, the makers have been enabled to simplify it by dispensing with many fixtures that were necessary in a combination machine, but unnecessary for a dovetailer alone. While nothing of its efficiency as a dovetailer has been sacrificed by this change, the cost of the machine has been materially reduced.

Referring to the cut, which represents the independent dovetailer here referred to, we may explain that the frame is one solid casting; the top is of iron, planed smooth and true, 30 inches square. The spindle is erected in the center of the trunk, upon solid parts of the same. The upper journal runs in a babbitted box; the lower journal runs through a brass sleeve and rests upon a tempered steel pivot, and has an oil supply. It has a screw hand-wheel at the bottom for adjustment up or down. The cutter is held by a short steel chuck attached to the spindle by a taper fit, so that it will never get loose or out of line, and can readily be replaced when worn.

The makers confidently recommend this machine, not only for its cheapness, but also as being at once the most convenient, and having the most facilities for dovetailing of any machine thus far in the market. Although not automatic in its operations, it has all the speed and accuracy of an automatic machine, and is not difficult to manipulate. It will cut both the front and the side of a drawer at one time; and if narrow, two fronts and two sides at one time. It dovetails with equal facility on any thickness from ¼ inch to 1½ inches, and up to 13 inches in width. In short, it is in every particular the improved dovetailer that these makers have been using in connection with their well-known paneling machine. The manufacturers will furnish additional information an application.



BOULT'S INDEPENDENT DOVETAILER.

Completion of the St. Gothard Tunnel.

The telegraphic news from Europe on Tuesday, November 1st, conveyed the information that the first complete railway train, carrying 100 passengers, passed through the St. Gothard tunnel on that day, taking fifty minutes for the passage. This interesting event, therefore, signalizes the successful completion of the most important engineering work on the continent of Europe. In view of this fact, it may be of interest for us to place on record, for the information of our readers, a brief *resumé* of the history of this enterprise.

The first steps towards the construction of the St. Gothard tunnel were taken in the year 1870, when the governments of Italy, Germany and Switzerland jointly signed an agreement guaranteeing the sum of $17,000,000 to the company that would construct the St. Gothard railroad and tunnel. Of this sum, the Italian government pledged itself to subscribe $9,000,000; Germany, $4,000,000; and Switzerland, $4,000,000. After the work was well under way, the original estimates of $37,400,000 were found to be inadequate, and they were swelled to the enormous sum of $57,800,000, and Germany subsequently added $2,000,000; Italy, $2,000,000; and Switzerland, $1,500,000 to their original subscriptions.

Work upon the tunnel was begun in the autumn of 1872, and the headings met on the last day of February, 1880, the actual work of piercing the mountain requiring, therefore, seven years and five months, or about four and a half years less time than was required for the Mount Cenis tunnel. The average daily progress made was 18 feet, and 5,000 tons of dynamite were used in blasting. The work was attended with an unusually heavy loss of life, no less than 150 laborers being killed and 400 disabled. The deaths represented 1 per cent of the total number of those employed, and the injured 2½ per cent.

The rock through which the tunnel was pierced on the Swiss side, was a hard granite gneiss, and that on the Italian side softer, and more or less disintegrated. The progress through the former, contrary to what might have been expected, was much more rapid than through the latter, for the task of penetrating the softer material was often seriously retarded by the excessive infiltration of water. The work had frequently to be carried through beds of schist, from which the water was discharged in torrents. After the actual piercing of the tunnel had been completed, the most serious difficulty was encountered from the persistent swelling of a bed of porous absorbent rock, which repeatedly crushed the masonry built to retain it, and it was only after numerous failures that it was finally secured in place.

The St. Gothard tunnel proper begins at Goeschenen, in a defile where the river Reuss dashes beneath the famous Devil's Bridge, and ends at Airolo, where it overlooks the pleasant pastoral valley of the Ticino. Its length is 9¼ miles, or 48,936 feet, to be exact; it is 19¾ feet high and 26 feet in maximum width. But the tunnel is only one section of a railroad running from Lake Lucerne in Switzerland to Lake Maggiore in Italy. Besides the big tunnel, there are twelve others, the shortest of which, Warren, is 1,106 yards long, while the longest, the Olberg, reaches 2,027 yards. The total length of these twelve tunnels is very nearly 10 miles—15,578 yards. Then there are five tunnels between 220 and 550 yards, and twenty-five between 110 and 220 yards, making in all fifty-two subsidiary tunnels of an aggregate length of 16 miles. Between Immensee and Goeschenen there are thirty-three tunnels; between Airolo and Giubiasco, seventeen. The line is carried over 64 bridges and viaducts, the longest of which, that of Cadenazzo, in Tessin, consists of five arches each having a span of 55 yards. The total length of the Gothard line is 151 miles, 17 per cent of it being tunnels and 1 per cent bridges and viaducts. Starting from Rothkreuz, 11 miles from Lucerne, the St. Gothard line runs along the western shore of Lake Zug, round the base of the Righi and by Lake Lowerz, striking the lake of Lucerne at Brunnen. From Fluelen the line begins to ascend the valley of the Reuss, attaining an altitude of 1,558 feet above the level of the sea at the village of Erstfeld, 5 miles from Fluelen. Up to this point the gradient of the line nowhere exceeds 10 in 1,000; but from Erstfeld to the next station, Amsteg, it rises 26 feet in every 1,000. From Amsteg the line runs through a number of short tunnels and over a number of bridges to Gurtnellen, 8 miles from Fluelen, where it attains an altitude of 2,427 feet. From Gurtnellen the line ascends the mountain side in a series of bold spirals, crossing the Reuss several times, and passing through the Pfaffensprung tunnel, 1,611 yards in length; and then, running through the Wattingen tunnel, reaches the station of Wasen, 3,008 feet above the sea level. Leaving Wasen, the line runs back again in the direction of Fluelen, then turning, passes through the Naxberg tunnel, 1,700 yards in length, and reaches the station of Goeschenen. Here the St. Gothard tunnel begins.

The political and commercial importance of this great work have been fully set forth in a previous article in this journal, published in our issue for March, 1880, which, in connection with the present article, will give our readers a very complete history of the greatest engineering work in Europe.

Cement for Glass.

It is well known that when gelatine or glue is treated with bichromate of potassium it becomes insoluble after being exposed to the light. Where the exposure has been prolonged, the gelatine is not even affected by hot water. This peculiar change is known to depend on a chemical change taking place in the materials, the gelatine exerting, under the influence of the sunlight, a reducing action on the chromic acid of the bichromate, reducing the latter to the condition of chromic oxide. This change is clearly indicated by the change of the material from an orange-red to a dark-green color, the latter being a characteristic indication of the formation of chromic oxide.

This behavior of bichromated gelatine, as we have several times pointed out, is the basis of a number of photographic, photolithographic and photo-engraving processes, which have been brought to a high state of perfection. It is not so well known, however, that bichromated gelatine, rendered insoluble by exposure to light, makes an excellent cement for glass. This, however, is asserted to be the fact, and as it may prove useful to some of our readers, we give the following description of the mode of preparing and using the material for this purpose:

One part of a very pure and colorless gelatine is dissolved in 15 parts of water in which 3 parts of bichromate of potassium has previously been dissolved. This must be done in a dark place, or at least in a room illuminated only by a weak candle or gas light. And the mixture itself must be carefully kept from sunlight, best in a black bottle in a dark room. To cement fractured glass fragments together, the edges are first thoroughly cleaned, then slightly warmed, and coated with a *very thin* coating of the cement, in a dark room. The pieces are then pressed together, and, if at all possible, kept under pressure (by tying with cord, wire, etc.,) and then exposed to direct sunlight. If the edges have been thoroughly adjusted and the cement applied thin, even hot water will not separate the pieces. Opaque objects are not so thoroughly cemented together by this mixture, since the rays of the sun cannot strike the fractured edge throughout its whole extent.

To Fix Pencil Marks so they will not rub, take well skimmed milk and dilute with an equal bulk of water. Wash the pencil marks (whether writing or drawing) with this liquid, using a soft camel-hair brush, and avoiding all rubbing. Place upon a flat board to dry.

Removal of Flood Rock.

A glance at the map of New York and its surroundings, will show that there are two natural water-ways for the entrance of in-coming Vessels into the harbor of New York. By the route usually followed, vessels pass by Sandy Hook and in between Staten Island and the south point of Long Island. All vessels having considerable draft are obliged to use this route, although it is considerably more circuitous than the second route through Long Island Sound, between the

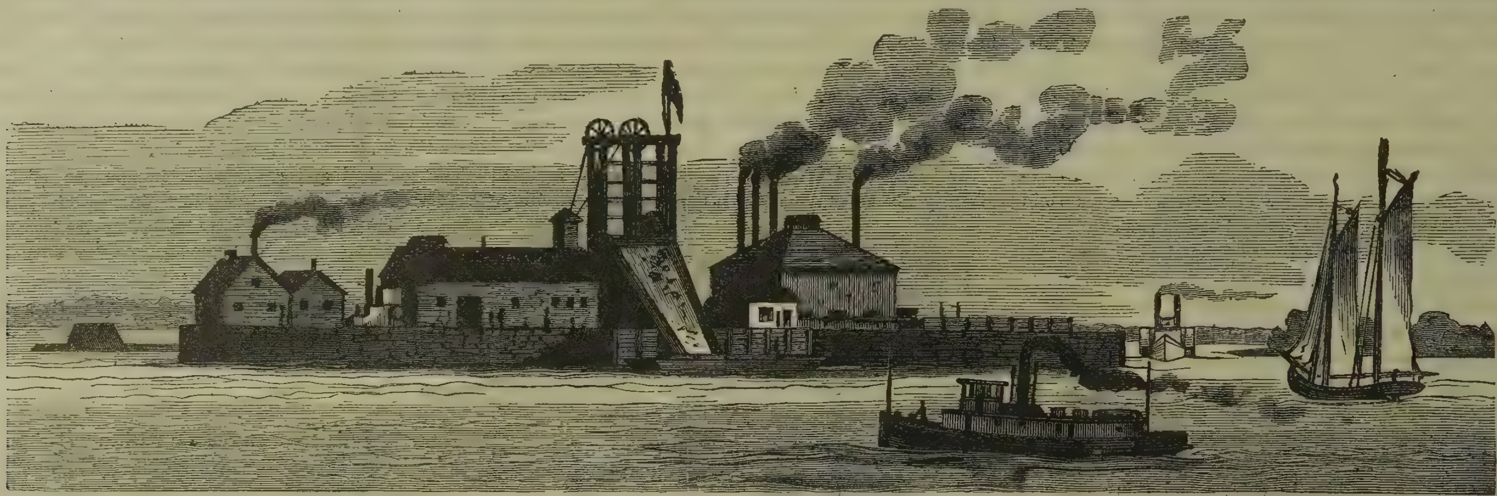


Fig. 1.—PRESENT APPEARANCE OF FLOOD ROCK.

mainland and Manhattan Island on the one side and Long Island on the other. This last-named passage, though the most direct, is only available to vessels of light draft, on account of the serious obstructions interposed by rock masses at Hell Gate. In view of the manifest advantages of the last named passage for all vessels entering New York harbor from Europe and the northerly Atlantic ports of the United States, the removal of the dangerous obstructions in this channel has been properly looked upon as of national importance, and the work has been actively prosecuted for a number of years under the supervision of the government engineers.

The method employed in these operations is very simple in principle, but the work is both costly and tedious, and requires the incessant care and vigilance of those in charge, as a single imprudent blast might delay operations for months, besides causing immense damage. The first step in this work is the accurate survey of the reef, both with reference to its shape and formation, its stratification and the presence or absence of faults or crevices. To aid in this necessary operation, the surface of the reef is first cleared off with the aid of ordinary dredging machines and the water jet apparatus, the latter serving to carry away the sand and smaller loose particles of rock. This accomplished, the point of attack is chosen, this being generally at some portion of the reef where it projects above the water surface. About this a coffer-dam is

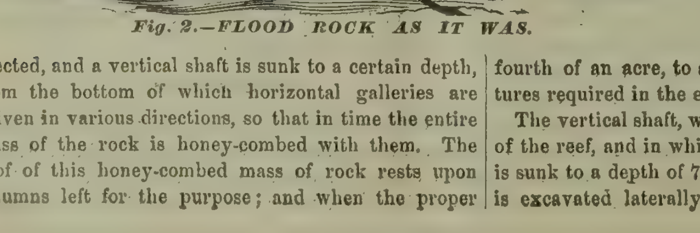


Fig. 2.—FLOOD ROCK AS IT WAS.

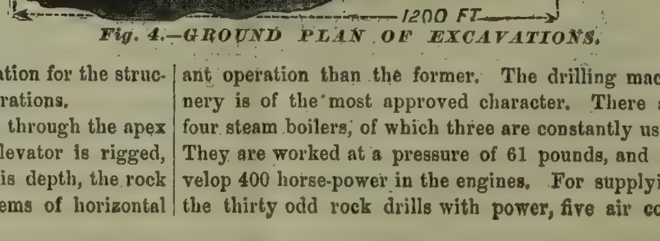


Fig. 4.—GROUND PLAN OF EXCAVATIONS.

erected, and a vertical shaft is sunk to a certain depth, from the bottom of which horizontal galleries are driven in various directions, so that in time the entire mass of the rock is honey-combed with them. The roof of this honey-combed mass of rock rests upon columns left for the purpose; and when the proper time has come, the purpose is to shatter these and the roof in one grand explosion. This accomplished, the shattered fragments of rock are removed by dredging until the proper depth of channel is obtained.

This method is being employed on an extensive scale in the removal of the above mentioned rock reef in New York harbor. The most dangerous portion of this is known by the characteristic name of Hell Gate, as there the dangerous currents and eddies caused by the flood and ebb of the tide have sent many vessels to destruction. The chart, numbered Fig. 6 in our illustrations, shows the arm of the sea which presents these dangers to navigation, and where the improvement works are in operation. In particular there were two reefs—Hallet's Point and Flood Rock—that offered the greatest obstruction to the passage of vessels of deep draft. Of these, the first has been substantially removed by earlier operations, the breaking up of the

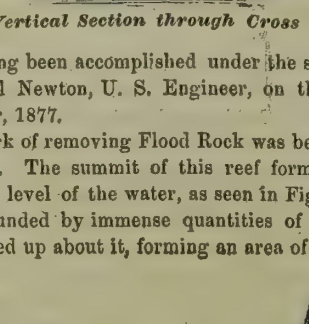


Fig. 3.—Vertical Section through Cross Galleries.

same having been accomplished under the supervision of General Newton, U. S. Engineer, on the 24th of September, 1877.

The work of removing Flood Rock was begun in the year 1876. The summit of this reef formerly stood above the level of the water, as seen in Fig. 2. Now it is surrounded by immense quantities of rock fragments, piled up about it, forming an area of about one-fourth of an acre, to afford a foundation for the structures required in the excavating operations.

The vertical shaft, which is driven through the apex of the reef, and in which a double elevator is rigged, is sunk to a depth of 75 feet. At this depth, the rock is excavated laterally by two systems of horizontal galleries crossing each other at right angles, so that at the points where they cross each other natural columns remain, which support the roof and the superincumbent mass of water. The tunneling in the rock —which consists of gneiss—is effected with the aid of improved rock drills driven by compressed air. The drill-holes have a diameter of 2½ inches, and are charged with cartridges containing about a pound of No. 2 extra giant powder. These charges are exploded at night, and simultaneously at all the charged holes. After each explosion—sometimes as many as 300 cartridges being fired at once—a large fan ventilator at the top of the shaft is set in full operation to remove the gases generated by the explosion, and purify the atmosphere in the excavation. When this is accomplished, the workmen return to their posts, the fragments broken off and thrown down by the explosion are loaded upon cars or wagons, and drawn by mules to the shaft, where they are hoisted to the surface by the elevator, and the rock drills are again set to work. From the elevator the rock fragments are loaded upon scows, which, when loaded, are towed out to some convenient point in deep water where their load is dumped.

The work above described is conducted with the utmost care, the great danger to be apprehended being the development or uncovering of fissures in the roof, through which the water might gain admittance in unmanageable quantity. Thus far no serious accident has occurred.

In our illustrations, Fig. 1 represents a view of Flood Rock as it now appears; Fig. 2 shows it as it appeared before operations for its removal were undertaken; Fig. 3 is a vertical section, showing the horizontal galleries; Fig. 4 is a ground plan of the excavations; and Fig. 5 a vertical section through the reef, showing the position of the shaft and the galleries.

The extent of reef to be removed at Flood Rock is much greater than that at Hallet's point; so that the latter will be a much more extensive and important operation than the former. The drilling machinery is of the most approved character. There are four steam boilers, of which three are constantly used. They are worked at a pressure of 61 pounds, and develop 400 horse-power in the engines. For supplying the thirty odd rock drills with power, five air com-

pressors are in use, compressing to a pressure of 55 pounds. Separate steam engines are in use to run the elevators in the shaft and the large fan ventilator of 12 feet diameter. Two Worthington twin pumps are in use to keep the workings free from water; and other engines are in use for special purposes. The escaping steam of the steam engines is conveyed to a large Lighthall surface condenser, in which about two-thirds of the water is condensed and fed to the boilers again at a temperature of about 100° Fah.

At present there are about 200 men at work on the

Fig. 5.—VERTICAL SECTION OF FLOOD ROCK.

Flood Rock excavation. The work is carried on day and night, the men being divided into three gangs, who work eight hours each. It is anticipated, if no unforseen accident occurs to interfere with the prosecution of the work, that the removal of this dangerous reef will be accomplished before the close of the year 1883. The Flood Rock excavation is in charge of Gen. John Newton, U. S. Engineer, who successfully superintended the removal of the Hallet's Point reef.

Steam Boiler Notes.

At midnight, November 10th, a steam rectifying column in Gaff's distillery, in Aurora, Ind., exploded from over pressure of steam, with such terrific force as to shake the town. The inflammable vapor that arose from the liquor took fire from a burning gaslight, and about 100 feet of the building was burned. William Fowler, a warehouseman, sleeping in the building, was killed, and his remains were found among the ashes on the following morning. The loss is variously estimated at from $25,000 to $40,000. Insurance, $14,200.

Ten boilers in the extensive lumber and salt manufactory of Hamilton, McClure & Co., six miles below East Saginaw, Mich., exploded about 5 A.M., November 13th, wrecking property to the extent of $25,000, and killing four firemen, Michael and Joseph Lehan, Frank Blanchard and Charles Carpenter. The brick boiler-house and brick chimneys were leveled with the ground, and the mill and salt block badly damaged. The *débris* was scattered in every direction, pieces coming down half a mile distant. Low water, as usual, is said to have been the cause of the above explosion. It is to be hoped that competent boiler inspectors will find their way to the scene of this disaster in time to make an exhaustive examination, because the phenomena, as related by non-professionals, are such as usually attend the sudden liberation and expansion of a large volume of highly heated water, rather than such as arise from the collapse of an overheated internal flue, or the escape of steam from an over-heated externally fired boiler shell in which there was little or no water.

The tugboat Lehigh, owned by William J. Wilson, of Albany, N. Y., exploded its boiler November 14th, between the main land and Starin's Glen Island, Long Island Sound, and one man was killed. The tug was engaged on the work of towing out of the harbor scows filled with mud and rocks taken from the work being done there by the government in deepening New Rochelle harbor. There are two dredges at work in the harbor, one, the Niagara, belonging to Contractor Seward, and the other, the Kinderhook, belonging to E. M. Paine, of Albany. Mr. Seward had chartered the tug Lehigh to tow the scows out into deep water and dump them. This was generally done off Huckleberry Island, some distance down the Sound. Hugh Chard, of West Troy, N. Y., is the captain of the tug, and Warren C. Norris, of Albany, the engineer. At about 12.30 P.M. the tug was lying at anchor alongside of a water boat, owned by Mr. Paine, some 600 feet from the shore and dredges. At this hour, James Tillotson, the cook, was the only person on the tug. All at once there was a deafening report, and the spot

Fig. 6.—Position of Flood Rock in Hell Gate.

where the tug had been was enveloped in steam and flying timbers. When the steam cleared away the tug had disappeared, not a vestige of it remaining, and the side and deck of the water boat, to which it had been attached, were torn to splinters. Tillotson's lifeless body was soon after taken from the water, it having been blown at least 150 feet from the tug by the force of the explosion. A large piece of the boiler was blown to Mr. Emmett's place on the mainland, some 700 feet distant. An ax and adz, which had been on the tug, were found on Hunter's Island. The boiler of the tug was inspected about a month before the explosion, by Charles Harvey, a local inspector at Albany, and passed as all right and safe to carry at least 75 pounds of steam. The tug was overhauled and repaired about a year ago, and the boiler, then an old one, was put in. The tug was valued at $3,500. The engineer said before leaving New Rochelle, that, when he and the captain went off the tug to go fishing, he, as a precautionary measure, opened the furnace door under the boiler, and otherwise so attended to it as to be assured of its safety. He was positive that there was not over 60 pounds of steam in the boiler when he went away, and he could not explain why it exploded. It was learned in New Rochelle that some part of the boiler gave way a short time before the 14th, and it had to be patched up. The cause of this explosion seems to be "engineer went a-fishing," left steam up and fire burning, with probably an inefficient safety valve.

It appears from a late number of *L'Ingenieur-Conseil*, that the Belgian Association for the Survillance of Steam Boilers has made a report showing that they have two thousand boilers under inspection, and that during the existence of the association it has had but two accidents. A clause has been lately added to its rules to the effect that its responsibility will cease on notification of the discovery of a dangerous defect in any member's steam boiler till such time as the defect shall be repaired in accordance with its directions.

By the force of the explosion at the Alvarado Sugar Mill, Cal., on September 27th, the second boiler was rendered useless; the roof of the boiler-house was blown to pieces and scattered in every direction, and the main mill was ignited by the flames.

Cotton Seed Oil.

According to a late report of our consul at Naples, cotton-seed oil has found its way into the remotest corners of Italy, and unadulterated olive oil is as difficult to obtain there, he affirms, as it is here. In view of the almost universal use of this oil to adulterate olive oil, and of the fact that there is nothing the least objectionable in the refined cotton-seed oil to debar it from use as a table oil, the consul suggests that it would be decidedly advantageous, instead of sending the oil abroad and buying it back again in the form of olive oil (with little or none of the latter about it save the name), after paying carriage both ways and duties, besides the dealers' profits, to keep it home and put it in the home market, after careful refining, as table oil,

The Physiology of Vision.

(*Concluded from Page 259, November Number.*)

It is a curious fact that one spot on the retina, not very far from the most sensitive portion, is entirely insensitive to light, and, what at first sight may appear still more curious, this *blind spot* is at the entrance of the optic nerve, where the nerve fibers are most numerous, and where it might be thought that vision would be most acute. But the nerve fibers belong to the conducting layer of the retina, and the percipient layer, or Jacob's membrane, is of course wanting at the point where these fibers pass through it. The existence of this blind spot is very easily demonstrated by means of Fig. 6. Close the left eye, and direct the right to the small cross on the left hand side of the figure. Hold the page vertically before the eye, ten or twelve inches off, and then gradually bring it nearer, still keeping the gaze fixed upon the cross; the round spot will also be visible, except at a certain distance from the eye—about seven inches—when its image falls upon the entrance of the optic nerve, and it disappears from view. This is illustrated in Fig. 7.

In tracing the rays of light to the retinal image, we have, so far, proceeded as if the rays from all objects required the same degree of refraction to focus them accurately on the retina. This is, however, the case only with distant objects, the rays from which come to the eye practically parallel. All the rays in nature, whose course has not been interferred with, are divergent; but beyond a distance of fifteen or twenty feet the divergence is so slight as to be inappreciable,

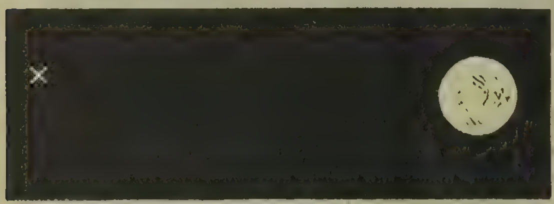


Fig. 6.

and they are considered as parallel. When the object is brought nearer to the eye, the rays from it are then practically divergent, and require to be more strongly refracted to bring them to a focus, (Fig. 8). This is a familiar fact in the use of any optical instrument, as an opera-glass; when directed from a distant to a near object, its focus must be adapted to the divergent rays by a mechanism provided for the purpose.

It is easy to prove that the eye forms no exception to this rule. If we hold a veil between our eyes and a book, we can either read through it or see its meshes distinctly, but we cannot do both at the same time. While we read, the veil resolves itself into a kind of vague mist, and when we look sharply at the veil the print is no longer legible, but blurred and confused. When a fly is seen distinctly on a window-pane, the landscape beyond is obscure; and when the landscape is sharply defined, the fly becomes a shapeless spot. Such experiences show clearly enough that some change takes place in the eye to adapt it to different distances, and, indeed, Kepler long ago demonstrated that this was a mathematical necessity. Few physiological or mathematical problems have excited more interest or enlisted more talent than the determination of the nature of this change and the means by which it is accomplished. It is now known that the increased refraction by which the divergent rays from near objects are accurately focused on the retina is the result of an increase in the convexity of the lens. When we look at a near object the lens is rendered more convex by the action of the ciliary muscle—a small muscle in the interior of the eye, situated beyond the margin of the lens and connected with the delicate ligament that holds it in position. Every act of near vision, therefore, is accompanied by muscular effort. The ciliary muscle does for the eye what the adjusting screw does for the opera-glass. The dotted lines in Fig. 9 show the increased curve in the lens in adjustment for near objects, and its effect in focusing the divergent rays. This faculty of adapting itself to various distances is called the *accommodation* of the eye, and is brought into requisition whenever there is the slightest change in the distance of any near object that we look at.

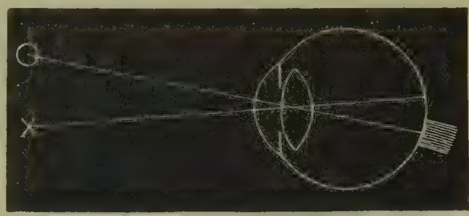


Fig. 7.—Blind Spot on Retina.

The simultaneous use of both eyes is called "binocular vision," and to secure its correct and full effect, the eyes must have nearly the same acuteness of vision and degree of refraction, and the action of the external muscles must be so balanced that both eyes may be properly directed to the same object. There are, of course, two images formed of every object that we look at, one on each retina, and they are so combined by the brain as to give the impression of one object only when they fall on what are called "corresponding parts" of the two retinæ. Taking the yellow spot for the central point, the corresponding portions are those above in each eye or below in each, or on the inner side of one retina and the outer side of the other—that is, the portions that would come in apposition if one retina were placed upon the other. The most perfect binocular vision is when both images are on the yellow spots, but there is not double vision unless the images fall on other than corresponding parts, when they are immediately perceived separately, and two objects appear.

This is easily shown by pressing one eye slightly out of position with the finger, when everything will be seen double. Or hold two pencils in a direct line before the eyes, six or eight inches apart, and fix the eyes on the nearer one; the other will appear double because its image falls upon portions of the two retinæ that do not correspond.

The principal advantages of binocular vision are in the appreciation of the solidity (the "three dimensions") of objects, and in the accurate determination of distances. When we look at a solid object (with both eyes), the images formed on the two retinæ are not precisely alike; that in the right eye includes more of the right side of the object, and that in the left eye of the left side, and the combination of these two images gives the "stereoscopic effect," or impression of relief. This effect is imitated by the stereoscope, in which we have two slightly different pictures of an object, one taken from the right side and the other

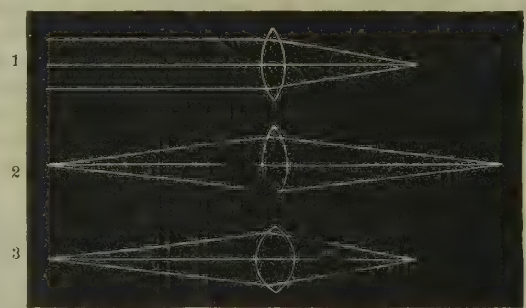


Fig. 8.—1. Focus of Parallel Rays. 2. Focus of Divergent Rays. 3. Focus of Divergent Rays brought forward by more Convex Lens.

from the left, and are enabled to combine them by means of prisms. The effect is even exaggerated by making the distance between the cameras, when the photographs are taken, greater than that between the eyes, which makes the difference between the pictures more decided.

We are greatly assisted in the estimation of distances by the simultaneous use of both eyes, for each eye gives accurately the *direction* of the object, and we know that its position must be at the intersection of these lines of direction. Persons who have lost one eye are much inconvenienced by the want of this assistance, as may be appreciated by attempting to thread a needle, or to touch a spot on paper with the point of a pencil quickly, with one eye closed.

In looking at an object closely, the eyes are turned towards it, or *converged*, by the action of the internal straight muscles—another muscular effort involved in near vision, which is from being the merely passive sensation that it is too often considered.

The correct interpretation of the impressions received by sight, is, after all, to a great extent a matter of practice and education, with the assistance of the sense of touch. This is proved by numerous observations made upon persons who have been born blind, and whose sight has been restored, or rather acquired, by surgical operation. None of these persons have shown any indication of an instinctive use of their new-found sense; all have had to learn to see. None could distinguish form or distance, or could recognize at first, by sight alone, even objects that had been familiar to touch for years. Some seemed to find their first experiences painful rather than pleasant; and it is related of one, who had earned his living as a street musician and had gone about the town alone for years, that he became confused and lost himself when his eyes were opened, and had to beg some one to lead him home. All this is well illustrated in the interesting and instructive, even if somewhat apocryphal, story of Casper Hauser, who was imprisoned in a dark cell for the first sixteen years of his life.

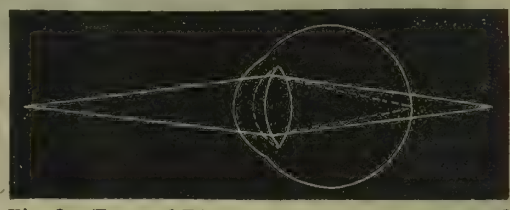


Fig. 9.—Focus of Divergent Rays brought Forward to Retina by Increased Convexity of Lens.

Ebonized Wood.

A very simple process for ebonizing wood is given in the *Art Interchange*, as follows: "The wood is first stained with a decoction of logwood, which may be purchased from any druggist. It is dissolved in warm water until all has been taken up that the water will hold. Application to the wood is made freely with a large soft bristle brush, and the surface is rubbed with a cloth to prevent the formation of a gummy coat thereon. After the article has been left to dry for a few hours, the second application, which consists of vinegar in which a quantity of nails or clean filings have been soaked for several days, is also freely laid on with a brush. The moment the vinegar touches the wood it combines with the logwood solution in the pores, making an ink which is a permanent jet black stain. The influence of the iron in the vinegar is all-important. If any tendency to grayness is noticed, a second treatment is necessary; but this seldom happens. When perfectly dry, the article is varnished and rubbed down, or finished with furniture oil well rubbed in. Cherry is considered the best wood for ebonizing. Whitewood, maple and beech are used with good effect. Any close grained, dense wood will answer—ash, chestnut and oak are not suitable. This process, it is said, is used for fine ebony and gold furniture."

LIFE OF STEEL RAILS.—An engineer of the Rhenish railway, which has had the longest experience in steel rails, has made a calculation, according to which the average duration of steel rails, when 24 trains pass over them every day, is 30 years, while that of iron rails, with a traffic of 17 trains, is 11 years. Steel rails, according to this calculation, last four times as long as iron rails, although they are but one-third more expensive.

A Promising School of Mechanical Handiwork.

In our issue of February, 1880, we had occasion to refer at some length to the establishment of several technical schools in our neighbor city, Philadelphia, and among these we noticed the opening of an experimental school of mechanical handiwork by the managers of the Spring Garden Institute, in which the necessary elementary operations of working in wood and metal would be taught to young men in a systematic manner, coupled with such instruction on the nature of the materials employed, the proper method of handling and using tools, and on the philosophy of the operations performed as could only be picked up in a disultory and imperfect manner in the workshop. This experiment has turned out to be most gratifyingly successful, and from small beginnings has now grown to considerable proportions. The managers of the Spring Garden Institute, to accommodate the pupils who presented themselves, and to provide for some advanced instruction, have just completed the fitting up of the entire basement floor of their large building at the corner of Broad and Spring Garden streets—a floor space of 1,455 square feet—for their handiwork classes. The new work-rooms have a cement flooring, and are well lighted, heated and ventilated, and provided with every facility for thorough instruction in the elements of mechanical handiwork.

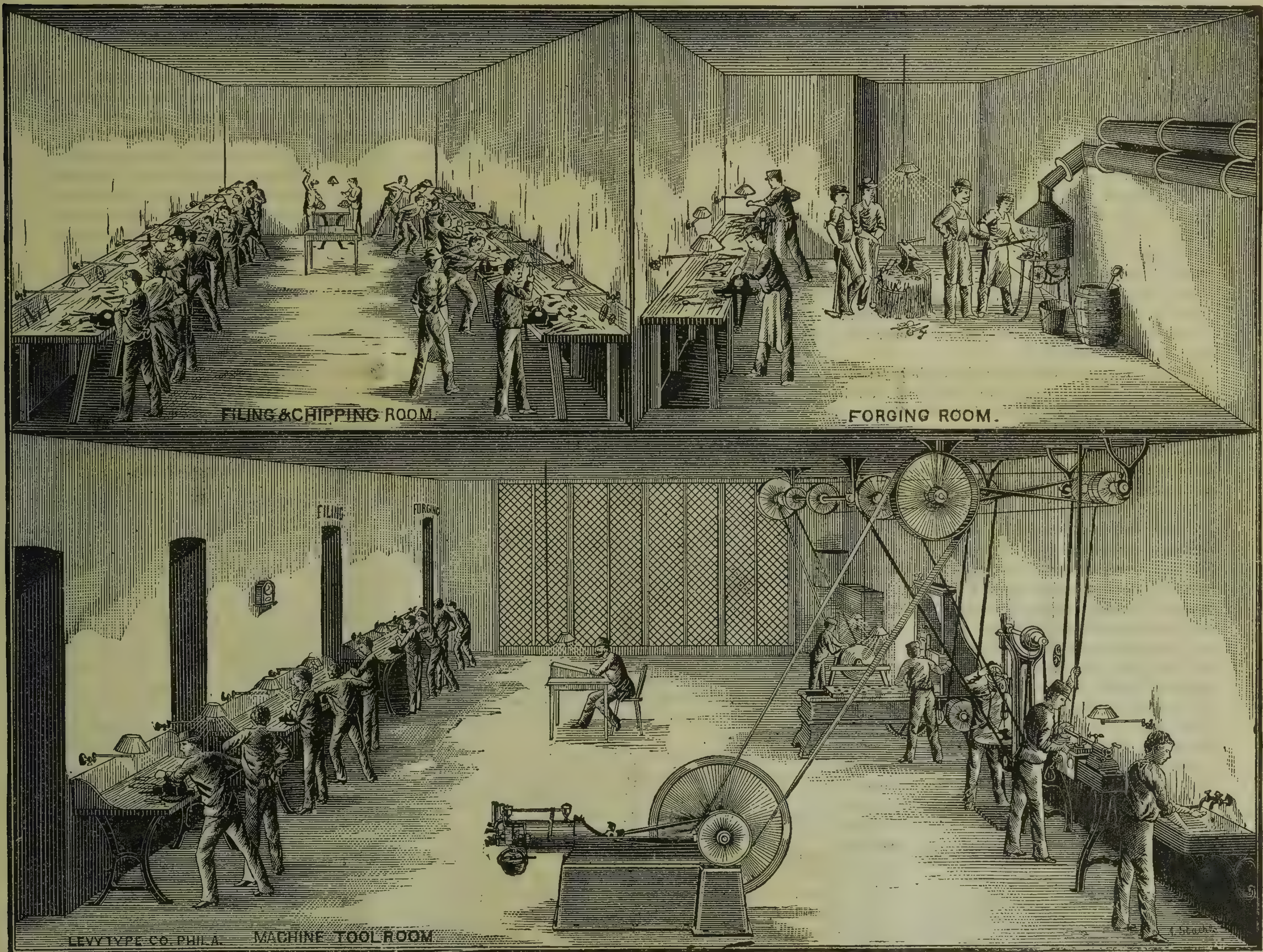
The course of instruction will embrace filing, turning, drilling, forging and other mechanical handiwork. The vise work course will consist of chipping to line, flat filing (in cast iron, steel, brass and wrought iron), scraping, parallel and taper filing, straight inside filing, reaming, finished work and polishing, joint work, key fitting, etc. The facilities of this department have been largely increased in the new workshop, and comprise some 26 vises and 160 running feet of bench room.

In the department of power and machine tools instruction will be given in the use of the power planing machine, turning lathes provided with modern screw-cutting attachments, etc., the uses of the upright drill, etc. In addition to the plant used in the school during the past two years, there has been added the full equipment of a modern machine shop, an Otto silent gas engine, power planing machine, lathes, drill press, etc., with the necessary shafting, counter-shafts, etc. The managers have also added a new department for practical instruction in forging, having provided a modern forge with all necessary tools, and a competent instructor in plain and intricate forging, welding, etc. As the demand may warrant, it is also proposed by the managers to include in their programme courses in foundry work (molding and casting), which will complete the metal course; and also, as soon as circumstances justify it, to include wood working by taking in such branches as carpentry and joining, wood-turning, cabinet-making, pattern-making, etc.

The new workshop was opened on Monday, November 7th. The applications for admission considerably exceeded the expectations of the managers. One hundred and twenty pupils were enrolled, and were divided into three classes, to which instructions are given on separate evenings. The charge for instruction is merely nominal, and among the pupils are enrolled many apprentices from the various machine shops of the city, to whom such tuition will be of special advantage. The general charge of the workshop is confined to Mr. T. Mason Mitchell, of the Baldwin Locomotive Works, and the practice shops are each in charge of experienced workmen.

The value of such schools as this to manufacturers, and to young men intending to take up one of the mechanical trades, cannot well be estimated. Under the careful instruction here afforded, the learner, though entirely without knowledge of tools, can become skilled in the proper method of holding, using and caring for them, far more rapidly than when left to his own devices to pick up the information in the machine shop; and this sort of mechanical training will be of great service to young men whether they design to enter a mechanical trade or not, as there is scarcely a single branch of manufacturing where a knowledge and skill in the use of tools will not be found useful and profitable to their possessor.

We present herewith a view of the interior of the new workshop of the Spring Garden Institute, which will give an idea of its arrangement. In addition to the mechanical handiwork department, the institute conducts also a large and flourishing school for instruc-



MECHANICAL HANDIWORK DEPARTMENT OF THE SPRING GARDEN INSTITUTE.

tion in mechanical, free-hand and architectural drawing, in which this season no less than 450 pupils received tuition. The drawing schools occupy the third story of the large building. The second story is taken up by the lecture-room, which can accommodate 600, and where courses of free lectures are delivered during the winter months. The first floor is occupied by the library and reading-room. The institute is admirably situated for its work, being in the immediate neighborhood of many of the largest machine works in Philadelphia, and the remarkable success of the new departure in engrafting practical training in mechanical handiwork upon the other educational work of the institute has been a source of much gratification to its managers, many of whom looked upon the experiment doubtfully.

New York Trade Schools.

The New York trade schools have been opened for the season in a building erected for the purpose on First avenue, between Sixty-seventh and Sixty-eighth streets. The course of instruction in plumbing and sanitary engineering comprises practical instruction in the manual branches of the trade, and lectures on the science of plumbing and on sanitary engineering. The instruction is designed for beginners and for young men and apprentices learning the trade in shops. On the completion of the course, those who are sufficiently advanced will receive a diploma. Instruction in the manual branches is given daily from 8 A.M. to 5 P.M., and the course, which began December 1st, is to continue until March 1st.

There is a general course for thorough instruction in house, sign and decorative painting in all its branches, and special courses for instruction in mixing colors, fresco painting, and in polishing and preparing hard wood. The general course is intended for beginners, or for those partly skilled. The special courses are intended for skilled workmen who desire instruction in a particular branch of their trade.

The instruction in the science and practice of bricklaying is commenced with the advice of Union No. 2 of the National Bricklayers' Union. The instruction is given on Monday and Friday evenings, and continues until March 15th. The scientific course comprises instruction in mechanical drawing, in laying out plans from architects' drawings, and in the principles governing the strength of walls and the thrust of arches. The practical course includes mixing mortar and cement, laying of face brick, building solid and hollow walls, flues and fire-places, construction of simple, groined and elliptical arches, cutting of brick for arches and moldings, and the formation of brick moldings and cornices.

The charge for three months' instruction in manual plumbing is $35. Evening lectures may be attended for $3. The general course of painting costs $65, and bricklaying $5, or $1 a month.

Liquid Carbonic Acid.

The chemical works of De Haen, in List, near Hanover, have for some time past been engaged in the manufacture and sale of liquid carbonic acid. The liquid is compressed in cylinders having a capacity of about 10 liters, which are tested to a pressure of 100 atmospheres. Should the railway companies decide to carry these cylinders, it is expected that the liquid acid will soon come into general use in the soda water trade.

Scientific.

MINERALOGICAL NOTES AND NOVELTIES.—Prof. George A. Koenig, of the University of Pennsylvania, describes, under the name of *Alaskaite*, a new mineral belonging to the series of bismuth sulpho-salts. The new mineral is found in the Alaska vein, in Poughkeepsie Gulch—one of the head forks of the Uncompaghre river in Southwestern Colorado. The Alaskaite occurs in the vein associated with gray copper, in a gangue of quartz and barite. The new mineral occurs in small foliated particles, with smooth cleavage planes occasionally observable. Its color is whitish lead-gray, approaching bismuthinite; its luster is strongly metallic, opaque; color of the fine powder, bluish-gray. Its hardness could not be determined, but the mineral is easily friable in the mortar; specific gravity was found to be 6.878. Before the blow-pipe the mineral gave evidence of the presence of lead, silver, bismuth and sulphur. It dissolves completely and rapidly in hot concentrated hydrochloric acid. Analysis of the mineral gave the following percentages:

Bi=56.97	per cent.
Sb= 0.62	"
Pb=11.79	"
Ag= 8.74	"
Cu= 3.46	"
Zn= 0.79	"
S = 17.63	"
100.00	

Other samples showed on analysis that the silver was in greater part replaced by lead.

Prof. Benjamin Silliman reports the recent discovery by himself of *Vanadinite*, and other crystalline salts of lead, of great beauty of color and perfection of form, in Arizona. Some of these minerals, for example *Crocoite*, a chromate of lead, and *Vauquelinite*, a variety containing copper, are affirmed to have been discovered for the first time in North America. *Vanadinite*—cloride of lead and vanadium—hitherto a rare mineral, appears, from these discoveries, to be quite abundant in the silver district in Yuma county and other localities. It occurs in veins of quartz, lying between footwalls of granite and hanging walls of porphyry, and occurs associated with argentiferous galena and other lead minerals. In this way it has been found in the Hamburg, Red Cloud, and the Princess mines. The crystals are small, but highly lustrous, and vary in color from a deep orange to a reddish-yellow and brown.

In the Collateral mine there was noticed a mineral which is suspected to be *Descloizite*, but the specimens found were not sufficient to determine its identity accurately. In the same mine, also, the presence of *Volborthnite* was strongly suspected; and in this mine, and also in the Chromate, a mineral like Domeyko's *Chileite* was observed. What may prove to be *Mottramite* has been found at the Frenchman's mine; and *Wulfenite*, malybdate of lead, which does not contain vanadic acid, has been found in crystals of rare beauty at the Red Cloud.

Three of four species of the *Crocoite* group—that is, chromic acid with oxide of lead—occur in the Collateral and Chromate veins, but the quantities found were not sufficient to identify them.

F. W. Clark and M. E. Owens have analyzed a mineral from an unknown locality in Nevada, and announce it to be a new variety of *Tetrahedrite*, containing a much larger percentage of lead than the usual mineral. They believe it to be a new variety of tetrahedrite.

H. B. Corunnel has made examinations of the well-known dense gray blende of Friedensville, Pa., and of the yellowish-brown blende of Phœnixville, Pa., and has found distinct evidences of the presence of gallium in each. Specimens of blende from Joplin, Mo., Warren, N. H., and Ellenville, N. Y., also showed evidences of the presence of this rare metal by spectroscopic examination.

Peter Collier has examined a mineral resembling *Thorite*, probably from the Champlain iron region. In color, hardness, specific gravity, etc., it is identical with thorite or orangite. The analysis showed a high percentage of uranium, on account of which he proposes for it the name of *Uranothorite*.

OUR MEASURE OF TEMPERATURE.—The Prussian merchant named Gabriel Daniel Fahrenheit, from a boy was a close observer of nature, and when only nineteen years old, in the remarkably cold winter of 1709, he experimented by putting snow and salt together, and noticed that it produced a degree of cold equal to the coldest day of the year, and that day was the coldest day that the oldest inhabitant could remember. Gabriel was struck with the coincidence of his little scientific discovery, and hastily concluded that he had found the lowest degree of temperature known to the world, either natural or artificial. He called the degree zero, which word is from the Arabic, and means empty, or nothing, and constructed a thermometer or rude weather glass, with a scale graduating up from zero to boiling point, which he numbered 212, and the freezing point 32—because, as he thought, mercury contracted the 32d of its volume on being cooled down from the temperature of freezing water to zero, and expanded 180th on being heated from the freezing to the boiling point.

Time showed that this arrangement, instead of being truly scientific, was as arbitrary as the division of the Bible into verses and chapters, and that these two points no more represented the real extent of temperature than from "Dan to Beersheba" expressed the exact extremes of Palestine. But Fahrenheit's thermometer had been widely adopted with its inconvenient scale, and no one thought of any better, until his name became an authority, for Fahrenheit finally abandoned trade and gave himself up to science.

The three countries which use Fahrenheit are England, Holland and America. Russia and Germany use Reaumur's thermometer, in which to boiling point is counted 80 degrees above the freezing point. France uses the centigrade thermometer, so called because it marks the boiling point 100 degrees above the freezing point. On many accounts the centigrade system is the best, and the triumph of convenience will be attained when zero is made the freezing point, and when the boiling point is put 100 or 1,000 degrees from it, and all the subdivisions are fixed decimally.

ELECTRICAL HORTICULTURE.—At the late meeting of the British Association, held in York, England, Dr. C. Wm. Siemens, F.R.S., read a paper on some applications of electric energy to horticultural and agricultural purposes.

Dr. Siemens conducted his experiments from the 23d of October, 1880, to the 7th of May, 1881. The general plan of operation consisted in lighting the electric lights first at 6 o'clock, and during the short days at 5 o'clock, every evening, except Sunday, continuing their action until dawn. Previous experiments on the influence of the electric light upon vegetation had convinced him that the electric light was capable of producing upon plants effects comparable to those of solar radiation; that chlorophyll was produced by it, and that bloom and fruit, rich in aroma and color, could be developed by its aid. His experience also went to prove that plants do not, as a rule, require a period of rest during the twenty-four hours of the day, but make increased and vigorous progress if subjected in winter time to solar light during the day and to electric light during the night.

Dr. Siemens employed a 6 horse-power high-pressure steam engine and two dynamo machines, connected separately to two electric lamps, each capable of emitting a light of about 4,000 candle-power. One of these lamps was placed inside a glass house of 2,318 cubic feet capacity, and the other was suspended at a hight of 12 to 14 feet over some sunken green-houses. The waste steam of the engine was condensed in a heater, whence the green-houses took their circulating supply of hot water, thus saving the fuel that would otherwise be required to heat the stoves. The outside light was protected by a clear glass lantern, while the light inside the house was left naked in the earlier experiments. The house was planted in the first place with peas, French beans, wheat, barley and oats, as well as with cauliflowers, strawberries, raspberries, peaches, tomatoes, vines, and a variety of flowering plants, including roses, rhododendrons and azaleas. The temperature of the house was maintained at 60° Fah. The plants in the house under the influence of the naked

light did not do well. They had a sickly, withered appearance. After various experiments, it was found necessary to put a lantern of clear glass around the light, for the double purpose of discharging the chemical products of the arc and of interposing an effectual screen between the arc and the plants under its influence. The effect was striking, and could be observed on a tomato plant in a single night. Experiments demonstrated that the plants flourished best under clear glass, next in order under yellow glass, then red glass, and finally blue glass, which last produced lanky growth and sickly leaf. Whereas the clear glass does not intercept any of the luminous rays, these cannot be the cause of the destructive action on plants; but as it is thought to absorb the highly refrangible invisible rays with which the electric arc is particularly rich, it is, doubtless, these last-named rays which work destruction on vegetable cells.

Under the influence of clear glass and electric light, peas, which had been sown at the end of October, produced a harvest of ripe fruit on the 16th of February. Raspberry stalks put into the house on the 16th of December, produced ripe fruit on the 1st of March; and strawberry plants, put in about the same time, produced ripe fruit of excellent flavor and color on the 14th of February. Vines, which budded on the 26th of December, produced ripe grapes of stronger flavor than usual on the 10th of March. Wheat, barley and oats shot up with extraordinary rapidity under the influence of continuous light. Even in the open air, under the electric light, seeds of the grains produced satisfactory results.

Dr. Siemens says that he feels bound to state as the result of all his experiments, extending now over two winters, that although periodic darkness evidently favors growth in the sense of elongating the stalk of plants, the continuous stimulus of light appears favorable for healthy development at a greatly accelerated pace, through all the stages of the annual life of the plant, from the early leaf to the ripened fruit. The latter is superior in size, in aroma, and in color to that produced by alternating light, and the resulting seeds are not at any rate devoid of regerminating power. The electric light has had a very beneficial influence upon a banana palm, and upon melons, both of which were remarkable for size and flavor. In conclusion, Dr. Siemens says: "I am disposed to think that the time is not far distant when the electric light will be found a valuable adjunct to the means at the disposal of the horticulturist in making him really independent of climate and season, and furnishing him with a power of producing new varieties."

Actinium, a New Metal.—The peculiar discoloration suffered by certain preparations of zinc pigment, manufactured by a process devised by Dr. Phipson, an English chemist, and which we have alluded to in this journal, led him to suspect the presence of a new metal as the predisposing cause of this curious behavior. After a thorough investigation, Dr. Phipson announces this to be the case, and that he has succeeded in isolating the new metallic element in the form of sulphide and oxide.

From the somewhat meager accounts of this investigation that have thus far appeared, we glean that the oxide of actinium is white, with a tinge of salmon-yellow. It is distinguished from zinc oxide by its very slight solubility in caustic soda; and by virtue of this property its separation from zinc is effected. It is not affected by sunlight, nor does it change color in the air like oxide of manganese. It is not precipitated by ammonia from solutions containing ammoniacal salts. The sulphide is of a pale canary-yellow color. It is insoluble in acetic acid, but readily soluble in mineral acids, even when they are somewhat diluted. The sensitiveness of the sulphide to sunlight, however, is its distinguishing characterestic, and the observation of this phenomenon is what originally led to the suspicion of the existence of a new elementary substance and its identification. When exposed to sunlight for about twenty minutes, it darkens, and finally becomes quite black. This color change does not occur, however, if the sulphide is protected from direct sunlight by a piece of ordinary window-glass. In explanation of this very curious property, it is very obvious that the rays to which the new sulphide is sensitive, are cut off or arrested by the glass. From this actinic property, Dr. Phipson gave the name of "actinium" to his new discovery, which promises to give the scientific world a subject of rarely interesting study.

New Units for Electrical Measurements.—One of the most valuable results proceeding from the Electrical Exhibition lately held in Paris, has been the practical unification of the terms employed in defining electrical measurements. Hitherto there has been much confusion caused by reason of the multiplicity of "units" employed by scientific men of different nations in describing or discussing the same subject, as each would employ the terms adopted and used by the particular school in which he had been educated. This confusion promises now to be entirely done away with by the agreement arrived at by the Congress of Electricians representing all the nations, to recommend the universal adoption of certain terms to convey certain meanings. We publish below the nomenclature which has met the approval of the Congress, and have little doubt that it will meet with general satisfaction.

At the Electrical Congress in Paris, above referred to, a committee on electrical units made the following recommendations, which were unanimously adopted: 1. The fundamental units be the centimeter, gramme, and second (C. G. S.) 2. The practical units, ohm and volt, to retain their present definitions. 3. The unit of resistance, or ohm, to be represented by a column of mercury of a square millimeter section at the temperature zero Centigrade. 4. An international commission, to be charged with the duty of determining by new experiments, for practical purposes, the length of the column of mercury, of a square millimeter section at zero Centigrade, which represents the value of the ohm. 5. The name ampere to be given to the current produced by a volt in an ohm. 6. The name coulomb to be the name given to the quantity of electricity defined by the condition that an ampere gives one coulomb per second. 7. The name farad to be given to the capacity defined by the condition that a coulomb in a farad gives a volt. Until something better is discovered than the English candle, the French *Carcel bec*, and the German standard for the measurement of the electric light, preference will be given to the Carcel lamp.

Forests and Rainfall.—Whether the forests insure a greater rainfall in their vicinity than is received upon an equal area of open land, has been disputed among scientific men, though the preponderance of opinion now seems to favor the conclusion that the rainfall is most abundant in wooded regions. This corresponds also with the prevalent belief of the common people—the unscientific but practical observers. A special committee of the Royal Academy of Vienna, Austria, reporting upon a "Memoir of Mr. Hofrath Wex upon the Diminution of the Water of Rivers and Streams," used the following language upon this particular point: "The question of the influence of forests upon the amount of precipitation, has for some time engaged the attention of naturalists. Such an influence has been asserted, partly from theoretic considerations and partly on account of the entire change presented by the climatic relations of the countries in which the forests have disappeared. It is probable that such influence exists; but while on the one hand its consequences may be over-estimated, on the other hand there is want of direct proof, inasmuch as the rain measurements have been continued for too short a time, both at stations situated within the woods and outside of them in the open fields. The commission consequently concludes that an influence of the woods upon the amount of rain deposited, and especially upon the yearly contribution, is probable, although direct observation does not give sufficient evidence to determine its extent, or positively its existence."

The Yellow Day.—The 6th of September, 1881, will be long remembered for the occurrence of a phenomenon throughout the New England States, which revived the historic reminiscences recorded of the "Dark Day" which was witnessed in that section in the year 1780, a little over 100 years ago.

On this day (September 6th), it is reported that the sky assumed an unusual appearance from the early morning, and at noon it was so dark that fowls sought the roost and artificial light was required in offices and business places and at the dinner table. The appearance of objects is described as being like what things would seem when viewed through smoked or stained glass. Vegetation appeared peculiarly green or blue, yellow objects of a sallow white, red objects peculiarly brilliant, while the blue wore a ghastly look. Towards sunset the phenomenon disappeared somewhat suddenly, and things again assumed their usual appearance. During the continuance of this singular phenomenon the air was quite still and calm.

Many theories and speculations have been advanced to account for it, but none thus far appear entirely satisfactory. It seems most probable that it was due to the smoke of extensive forest fires in Canada, mingling with a peculiar fog or overcast sky. The great forest fires then raging in Michigan may have likewise contributed to its occurrence.

Ozone at the Electrical Exhibition.—The editor of *Les Mondes* (Paris) has had a call from Dr. Tommasi, the distinguished Florentine chemist, who came to propose an idea to him that is worth publishing.

The Palace of Industry is at present a place where there is in circulation, especially during the evening, an immense quantity of electricity. Now, under the special and entirely exceptional conditions presented by this vast closed space saturated with electricity, it may be that the atmosphere undergoes peculiar modifications; for example, there may be a production of a certain amount of ozone. It would be extremely interesting, then, to put up an apparatus for collecting the ozone from the air, and which should work continuously at the exhibition. Such an apparatus was proposed by Dr. Tommasi in London seven years ago. The time seems to us opportune to perform these curious experiments. Dr. Tommasi is all ready to undertake them, but he needs for this the concurrence of some of our learned professors and the kind coöperation of the Commissariat of the Electrical Exhibition. We trust that neither will be lacking. Should these experiments take place, we will inform our readers of the results obtained.

Storage of Power.—Col. Frederick Beaumont writes thus to the London *Times*: "Attention having lately been directed through your columns to the storage of power by means of air and electricity, and it appearing from the speeches of the chairmen of certain railway and tramway companies that misapprehension exists with regard to the cost of air, I beg leave to state that air is now being compressed to 1,000 pounds on the square inch with far less cost and difficulty than has hitherto been accomplished with steam at high pressures. Independent proof of this will shortly be forthcoming from a body of well-known scientific gentlemen who have investigated and tested the matter for themselves. For locomotive purposes, the results obtained from the storing of electricity do not approach those obtained from the storage of air in the amount of force actually available for traction or propulsion. For tramways there is no doubt of the cost of air being considerably below steam, and air engines could be used on the Underground Railway at a cost in capital expenditure somewhat in excess of that for steam engines, but in daily working the expenses would be very trifling, if any, beyond the present cost of steam, while it is obvious that the difficulties of ventilation and deterioration of girders would vanish."

Flanging Boiler Heads.

The following article, which we reproduce from the monthly bulletin of the Hartford Steam Boiler Inspection and Insurance Company, will be read with interest by our mechanical readers:

The study of the causes and nature of the defect known as grooving, as well as the character and appearance of the fractures which frequently occur in the flanges of heads or tube sheets, and other parts of boilers where flanging is done, leads to the conclusion that flanges, as ordinarily turned, are very much too sharp, or turn at too short a radius. The evil effect upon iron of bending it too sharply is shown in Fig. 1, which represents a full size section of a tube sheet, at the angle or flange, bent to a radius equal to about the thickness of the plate, as frequently found in practice. Indeed, they are very frequently found with a still shorter bend—sometimes almost a sharp corner on the inside. The effect of this is to unduly strain the iron, both on the outside and inside of the flange, the outside being under a combined tensile and bending strain generally to such an extent that a section of the flange shows a laminated appearance, as seen in Fig. 1, caused by the layers of the plate being separated and sliding upon each other, while the outside of the plate, unless of extra fine iron worked with more skill than is usual, if examined closely, will be found to be filled with small cracks having the appearance of seasoned checks, as seen in timber. The inside of the flange, on the contrary, is in a state of undue compression, the fibers being crushed and buckled up, as shown in Fig. 1. The effect of too sharp flanging may easily be shown; by taking a narrow strip of boiler plate and bending it sharply, the effect will be very marked.

This disturbance of the fibers and laminæ of the iron renders it peculiarly susceptible to the corrosive action of the acids present to a greater or lesser extent in all waters, the result being manifested by grooving or channeling, and fracture along the angle of the flange, caused by the combined action of grooving and the "working" caused by variations of pressure and contraction and expansion. This is well illustrated by a recent case where the head of a boiler blew out. The fracture followed the angle of the flange entirely around; and in addition, the piece blown out, showed, upon careful inspection, to be full of cracks or checks in the immediate neighborhood of the flange and main fracture, which were evidently caused by the "working" due to great and sudden variations of pressure, which effect in this case was hightened by the injury done to the iron by too sharp flanging originally, and the total absence of the necessary bracing.

From close observation and long experience with such cases, we are led to recommend as proper for flanging, an internal radius of about four times the thickness of the plate flanged; or, for all ordinary boiler heads or tube sheets, flue plates, etc., of a thickness of from $\frac{3}{8}$ to $\frac{1}{2}$ inch; the internal radius may be 2 inches. Experience has shown that with this radius, and ordinarily good plates and careful working, there is no danger of injuring the plate during the operation of flanging. The flange will then have the proportions shown in Fig. 2, which is drawn one-half full size. This gives a very free, easy bend, by which the liability to groove is entirely obviated; at the same time the head will be considerably stiffer in consequence of the diminished area of the flat surface, while the bend will not interfere with placing the tubes, as no tube should be at a less distance than 3 inches from the shell of the boiler.

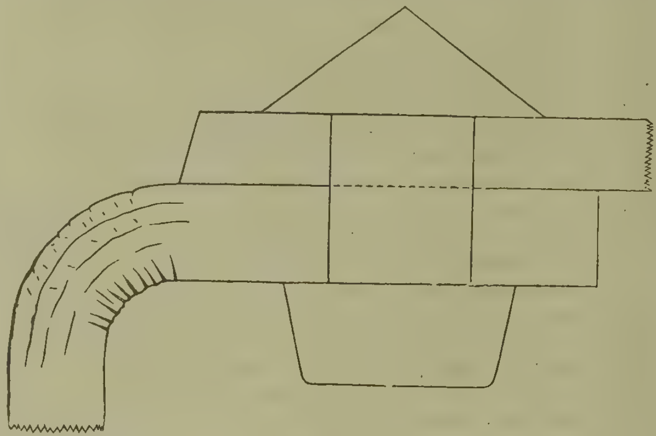


Fig. 1.

As regards the best method of turning the flange itself, there is no doubt that it can be done with proper machinery far better than by any other method. The usual method of performing the operation, which requires several heats and bending down a portion at a time, is objectionable for several reasons, but will probably continue to be used to a very great extent on account of the small first cost of the requisite plant. It would seem, however, that proper machinery might be constructed for a very moderate sum—for so small a sum, at most, that it would be a matter of economy in shops of any considerable size to do their flanging by machinery. That the system of flanging by machinery is both practical and economical is proved by the following, which is taken from *Engineering:*

"Boiler plates have been successfully flanged by hydraulic pressure for many years past, and we have frequently referred to hydraulic flanging machines in these columns. Their construction has hitherto rendered it necessary to make dies and blocks capable of flanging the plate in one operation, or squeeze, this entailing a considerable outlay in blocks and matrices; consequently, up to the present time these machines are chiefly used either by railway companies or leading firms of locomotive builders. . . . In agricultural locomotives, although the work is not so heavy, there is a very large output and a great repetition of parts, consequently we find that engineers making this class of machinery are extensive users of hydraulic flanging presses. . . . All the riveting at Wallsend is done on Tweddell's system, and the flanging and straightening machine we now illustrate is another application of the system to shop tools. The first object being to reduce the cost of the dies and blocks, it was decided to flange the plate gradually, or step by step, following as nearly as possible the process of hand flanging. Fig. 3 shows a side elevation of the machine arranged to flange a common head or tube sheet. In Fig. 3, A is a standard attached to the bed-plate B B; the former carries three hydraulic cylinders, C, D and E, and to the latter is fixed the small block F and center pin E. The plate having been heated for a length of 5 or 6 feet along its edge, is placed on the block F, which is merely a segment of a circle with a radius equal to that of the boiler head for which it is intended. On the plate being placed on this anvil or block, the hydraulic ram C is lowered down upon it; this acts as a vice and prevents the plate being dragged forward when it is turned over, as shown in Fig. 3, by the descent of the ram D. This ram carries a specially shaped tool for turning the edge of the plate over the end of the block or anvil. This operation being finished, the ram D is again raised to the position shown in Fig. 3, and the vise ram being released, the whole plate H is turned round on the center pin G, thus presenting a further length to be turned over; and the above operation is repeated until the whole length heated is flanged. As soon as the whole length is turned over, the plate is again turned round on its center G, and the ram D being raised out of the way, the horizontal ram E, fitted with a hammer head, then advances and straightens and squares up the flange against the anvil F, thus completing the operation.

"It is evident from this description that the block or anvil may be made to fit any irregular shape of plate, and when the flanges are straight, of course the center pin G is not used. . . . It will be observed that this system not only effects an immense saving in the cost of the blocks and dies for very large or irregular work, but for this class it avoids the outlay for a large heating furnace. The machine itself is also much cheaper, the cylinders of course being much smaller, owing to the work being done by several efforts instead of by one. The actual results, so far as the quality of the work is concerned, are excellent, and the economical results are also most satisfactory. To a certain extent the machine at present is not favorably placed for economical working, but the results up to now show that it can do a given quantity of work in less than half the time, and at half the cost, of the same work when done by hand. The quality of the work, moreover, is much superior to hand work, and there is a great saving in fitting and putting the boilers together."

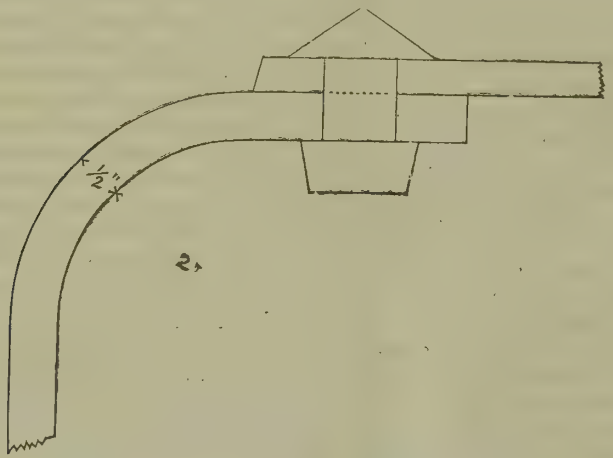


Fig. 2.

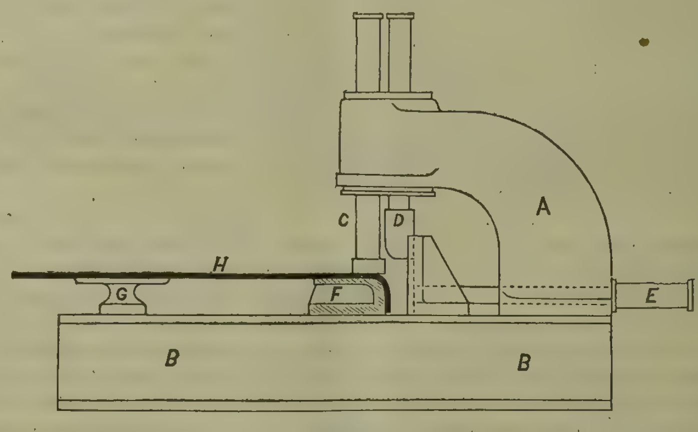


Fig. 3.

Where the usual method, however, is followed, care should be exercised that in the first place a good smooth former of the proper radius is used; then only the best flange iron should be put into heads; make the heats even, or of the same temperature each time as nearly as it is possible to make them; as much of

the head should be heated at once as it is possible to work before cooling, and no more; the work should proceed as rapidly as it is consistent with careful workmanship, and the iron should not be hammered after it is so cold that it would be likely to be injured thereby. All of these conditions can easily be attained by the exercise of proper care and oversight and the employment of good workmen, and then cases of grooved and broken flanges, in boilers of proper design, would become exceedingly rare.

Latest Market Report of Building Materials.

NEW YORK PRICES.

—o—

LUMBER.

Pine, very choice and extra dry, per M	$60 00 a 70 00
Pine, good	55 00 a 60 00
Pine, shipping box	21 00 a 22 50
Pine, common box	18 00 a 20 00
Pine, common box, ⅝	16 00 a 18 00
Pine, tally plank, 1¼, 10 inch, dressed, each	44 a — 50
Pine, tally plank, 1¼, 2d quality	35 a 38
Pine, tally plank, 1¼, culls	28 a 30
Pine, tally boards, dressed, good	30 a 32
Pine, tally boards, dressed, common	25 a 28
Pine, tally boards, culls, dressed	23 a 25
Pine, strip boards, merchantable	17 a 19
Pine, strip boards, clear	22 a 25
Pine, strip plank, dressed, clear	33 a 35
Spruce boards, dressed	25 a 27
Spruce plank, 1¼-inch, dressed	26 a 30
Spruce plank, 2-inch	43 a — 44
Spruce wall strips	14 a — 16
Spruce timber, per M	20 00 a 25 00
Hemlock boards, per M	16 00 a 18 00
Hemlock joist, 2½x4, each	16 a — 17
Hemlock joist, 3x4	18 a — 20
Hemlock joist, 4x6	40 a — 44
Ash, good, per M	55 00 a — —
Oak	60 00 a 65 00
Maple culls	25 00 a 30 00
Maple good	45 00 a 50 00
Chestnut	48 00 a 52 00
Cypress, 1, 1½, 2, and 2½-inch	35 00 a 40 00
Black walnut, good to choice	110 00 a 120 00
Black walnut, ⅝-inch	80 00 a 90 00
Black walnut, selected and seasoned	150 00 a 175 00
Black walnut counters, per ft	20 a 25
Cherry, wide, per M	90 00 a 110 00
Cherry, ordinary	60 00 a 80 00
White wood, inch	45 00 a 50 00
White wood, ⅝-inch	35 00 a 40 00
White wood, ⅝ panels	45 00 a 50 00
Shingles, extra sawed pine, 18-inch	4 00 a 5 00
Shingles, clear sawed pine, 16-inch	3 75 a 4 00
Shingles, cypress, 24x6	18 00 a 20 00
Shingles, cypress, 20x6	10 00 a 12 00
Lath, Cargo rate	2 00 a — —
Yellow dressed pine flooring	30 00 a 40 00
Yellow pine girders	32 50 a 40 00
Locust posts, 8 feet, per inch	18 a 20
Locust posts, 10 feet	24 a 25
Locust posts, 12 feet	29 a 34
Chestnut posts, per ft	3 a 3½
Basswood per M	25 00 a 30 00

Cargo rates, 10 per cent off.

BRICKS.

	Cargo.	Afloat.
Pale, per M.	4 50	a 4 75
Up Rivers	7 25	a 7 50
Jersey	7 50	a 8 00
Haverstraw Bay	8 25	a 8 37½
" " choice	8 50	a 8 62½
Favorite Brands	— —	a — —
Hollow Fire-Clay Brick	9 00	a 9 25

FRONTS.

Croton—Brown, per M.	11 00 a 12 00
" Dark	12 00 a 13 00
" Red	12 00 a 13 00
Philadelphia	30 00 a — —
Trenton	28 00 a 30 00
Baltimore	40 00 a — —
Clark's Glens Falls, White	23 00 a — —

Yard prices 50 cents per M higher, or with delivery added $2 per M for hard and $3 per M for front brick. For delivery add $5 on Philadelphia, Trenton and Glens Falls, and $6 on Baltimore brick.

IRON—PER TON.

Duty.—Bar, 1 to 1½c. per lb.; Railroad, 70c. per 100 lbs.; Boiler and Plate, 1½c. per lb.; Sheet, Band, Hoop and Scroll, 1¼ to 1¾c. per lb.; Pig, $7 per ton; Polished Sheet, 3c. per lb.; Galvanized, 2½c. per lb.; Scrap Cast, $6 per ton; Scrap Wrought, $8 per ton—all less 10 per cent. No Bar Iron to pay a less duty than 35 per cent ad val.

Pig, Scotch—Coltness	26 00 a 26 50
" Glengarnock	25 00 a — —
" Eglinton	23 00 a 23 50
" American, No. 1	25 00 a 26 00
" American, No. 2	22 50 a 23 00
" American, forge	21 00 a 22 00

LEAD—PER 100 POUNDS.

German	— — a — —
English, common	— — a — —
Spanish	5 75 a — —
Foreign, refined	— — a — —
Bar	6 50 a — —
Sheet	7 50 a — —
Pipe	— — a — —
Domestic	4 63 a — —

TIN PLATES.—Duty, 1 1-10 cents per pound.

I. C. charcoal, 10x14, per box	6 25 a 6 50
I. C. coke, 10x14	5 25 a 6 00
I. X. charcoal, 10x14	8 00 a 8 25
I. C. charcoal, 14x20	6 25 a 6 50
I. X. charcoal, 14x20	8 00 a 8 25
I. C. coke, 14x20	5 25 a 6 00
I. C. coke, terne, 14x20	5 00 a 5 25
I. C. charcoal, terne, 14x20	5 25 a 5 75

NAILS—PER KEG.

10d to 60d, common, fence and sheathing	3 30 a 3 40
8d and 9d, common	3 65 a — —
6d and 7d, common	3 90 a — —
4d and 5d, common	4 15 a — —
3d and 4d, light	4 95 a — —
3d, fine	5 65 a — —
2d, fine	5 65 a — —
Cut spikes, all sizes	3 65 a — —
Clinch nails, 1½ to 1¾ inch	5 65 a — —
do. 2 to 2¼ inch	5 40 a — —
do. 2½ to 2¾ inch	5 15 a — —
do. 3 inch and longer	4 90 a — —

SOLDERS.

Half and half	— 15 a — —
Exra	— 13½ a — 13¾
No. 1	— 12½ a — 12¾

ZINC.—Duty, sheet, per lb., 2½ cents.

Sheet, (cask) per lb	— 8 a — —
Sheet, (open)	— 8½ a — 9

STONE.—Cargo Rates Delivered in New York.

Amherst Sandstone, No.1, buff, in rough, pr. cub. ft.	1 00 a - —
do do No. 2	- 85 a - 95
Bedford Stone	1 25 a - —
Berlin Freestone, in rough	- 75 a 1 00
Berea Freestone, in rough	- 75 a 1 00
Brown Stone, Portland, Conn.	1 00 a 1 35
Bay of Fundy Wood Point Brown Stone	1 00 a - —
do Mary Point Brown Stone	1 00 a - —
do do Olive Stone	1 00 a - —
Brown Stone, Belleville, N. J.	1 00 a 1 35
Granite, rough	- 60 a 1 25
Canaan Marble	1 25 a 1 50
Sutherland Falls Marble	1 25 a 1 75
Dorchester, N.B., Stone, rough, per foot	1 00 a - —

PAINTS.

Carmine, American, per lb.	5 00 a 5 25
Chalk, per 100 lbs	— 35 a — —
China Clay, per ton	18 00 a 20 00
Chrome yellow, dry, per pound	— 12½ a — 28
Lead, red American, per pound	— 6¾ a — 7
Lead, white American, pure, in oil	— 7½ a — 8
Lead, white American, pure, dry	— 6¾ a — 7
Lead, white English, pure, in oil	— 9 a — 10
Litharge	— 6¾ a — 7
Ochre, Fr., dry, per 100 lbs.	1 50 a — —
Ochre, ground, in oil, per lb.	— 6 a — 15
Ochre, Vermont, per 100 lbs	— 75 a 1 00
Orange Mineral, English	— 9 a — 10
Paris White, American	— 1½ a — 1¾
Paris White, English, prime	— 2 a — 2¼
Paris Green	— 15 a — 28
Plumbago paint, patent, per lb	— — a — 25
Putty, per lb	— 2 a — 2½
Spanish Brown, dry, per lb	— 1⅛ a — 1¼
Spanish Brown, ground in oil, per lb	— 8 a — 9
Venetian red, per cwt	1 75 a 2 00
Vermilion, Chinese, per lb	— 85 a — 90
Vermilion, Trieste	— 70 a — 75
Vermilion, quicksilver, bags	— 50 a — 52½
Vermilion, American, common	— 15 a — 18
Whiting, per 100 lbs	— 60 a — 80
Zinc, white American, dry, No. 1	— 5 a — 7½
Zinc, white American, No. 1, in oil	— 8 a — 10
Zinc, white French, dry, (Red Seal,)	— 7 a — 8
Zinc, white French, in oil	— 10 a — 10½

VARNISHES—PER GALLON.

American Wearing Body	3 50 a 4 00
Coach Body	2 35 a 3 50
do do	1 80 a 2 00
Furniture	1 25 a 2 50
Black Asphaltum	1 00 a 1 50
Brown Japan	1 00 a 1 20
Liquid Paint Dryer	1 35 a 1 75
Harness, (black)	3 00 a 4 50
Shellac, Spirits	3 00 a 3 50

CEMENT—PER BARREL.

Portland (imported)	2 60 a 3 00
Portland (American)	2 25 a 2 50
Portland (Lafarge)	3 40 a 3 65
Lime of Teil	2 30 a 2 50
Lime of Teil, per ton	15 00 a 18 00
Roman	2 75 a 3 25
Keene's & Martin's, coarse	6 00 a 6 50
" fine	10 50 a — —
Rosendale	1 25 a 1 40

HAIR.

Cattle, per bushel of 7 lbs	— 16 a — —
Goat, " "	— 21 a — —

SLATE.

Purple roofing slate, per square	$5 00 a 6 25
Green slate	5 00 a 6 00
Red slate	9 00 a 10 00
Black slate, Pennsylvania, (at Jersey City)	3 50 a 4 50
Slate tiles, 1¼-inch, rubbed, per square foot	20 a — 25

PLASTER PARIS.

Duty.—20 per cent ad. val. on calcined; lump free.

Calcined, Eastern and city, per bbl.	1 20 a 1 25
Calcined, city casting	1 25 a 1 60
Calcined, city superfine	1 50 a 1 75

LIME—PER BARREL.

State, common	1 10 a — —
" finishing	1 25 a 1 35
Rockland, common, cargo rate	1 25 a — —
" finishing	1 40 a — —
Ground	1 10 a — —

Add 25 cents to above figures for yard rates.

FOREIGN WOODS.

MAHOGANY.

St. Domingo, crotches, ordinary to good, per ft	— 15 a — 28
St. Domingo, crotches, fine	— 20 a — 30
St. Domingo, logs, small	— 5 a — 8
St. Domingo, logs, large	— 8½ a — 14
Frontera, Mexican, large	— 9 a — 12½
Frontera, Mexican, small	— 6 a — 8
Other Mexican	— 6 a — 12½
Honduras	— 6 a — 12½

ROSEWOOD.

Rio Janeiro, ordinary to good, per lb	— 2½ a — 4½
Rio Janeiro, good to fine	— 5 a — 8
Bahia, ordinary to good	— 2½ a — 4½
Bahia, good to fine	— 5 a — 8
Honduras, per ton	10 00 a 20 00
Satin Wood, per foot	— 15 a — 75
Tulipwood, per lb	— 6 a — 7
Lignumvitæ, large, per ton	30 00 a 50 00
Lignumvitæ, other sizes	10 00 a 25 00

Review of the Markets.—In the lumber market during the past month, fine to choice goods have had a fair to quick demand, and have commanded full prices without difficulty. Stock of off-quality, however, has met uncertain attention, and frequently has been offered very low before a customer has been found. Builders are pretty well supplied so far as quantity is concerned, and in many instances could get along without further additions; but as really first-class stock is never out of place in a lumber yard, there is always a temptation to handle a little more, while strictly choice to fancy stock has certain special outlets which readily absorb anything available. Some anticipations of a first-class spring trade are entertained, but here and there a disposition has been shown among contractors to move with less freedom than at this time a year ago, and this is attributed to the general high cost of building material of all kinds.

In the brick market common hards have remained in very good shape; indeed, if anything, have strengthened a fraction, and the advantage has continued with the selling interest. Front brick have been scarce and firm.

In the lime market prices have been steadily advancing, and at this writing are very firm. The situation has been strong throughout, with the feeling that a much larger amount of stock could have been placed if here.

In the lath market there has been little or no change since our last, and on the whole has been rather quiet. The moderate movement, however, appears to have been more the result of an absence of supplies than a want of confidence, and dealers feel that a larger amount of stock could have been placed without difficulty, and at about former rates.

In the hardware market there has been occasional irregularity shown, and there is a natural expectation that the full uniform line of business so long current must be broken up before the end of the present month. Dealers, however, were prepared for something of this kind much earlier, and are therefore neither disappointed nor discouraged over the situation. Indeed, the general expression is quite as cheerful as could be wished, and the condition of the market strong and promising. Stocks of all kinds are moderate, and production will be kept down low for a month or two. On values the seller retains control, and there is a gradual tendency to advance on many articles.

In the paint market only a moderate and somewhat uncertain business has been doing in paints and colors, but still dealers have appeared to have been very well satisfied, and no serious complaints have been heard.

In the metal markets Scotch pig has not met with much demand for large blocks of stock, and a great many recent arrivals went to store to add to the accumulation. There has been, however, a fair call for jobbing parcels on orders for immediate use, and holders' views remain about firm. American pig has been handled only to the extent of immediate wants, but these have taken out a considerable amount of stock, and there has been no heavy or excessive offering from any source. Under these circumstances, the advantage has remained with sellers, and full former rates have been asked on all grades with a considerable degree of firmness. Manufactured iron has secured contined full attention, and with the immediately available supply very moderate, extreme prices have been secured readily, with an occasional lot in excess of quotations. Domestic pig lead has met with a good demand, principally from consumers, and with the increased cost of laying down stock here from the West, the market has been higher and firm. Pig tin has, as a rule, had an upward tendency on the favorable accounts from abroad and the confidence shown by holders here, but buyers have been a little cautious and have not invested freely at the cost. Tin plates have not met with much inquiry, and it is expected that the business will be of a jobbing character until after the turn of the year, and holders express no discouragement. Sheet zinc has been in good demand; there has been a very small supply, and prices have been firm.

The Architecture of Machine Shops.

The old notion that any kind of a building was good enough for a machine shop or factory, is fast becoming obsolete, and most of our manufacturers are now realizing that it pays to construct their buildings according to approved architectural plans, and to so arrange all the appointments as to furnish the best possible facilities for the prosecution of the business. But to do this requires an intelligent idea of what constitutes a proper building and its accessories, as well as a careful study of the arrangements of its interior plans, in order to avoid extravagance in design and finish, while providing necessary room and appropriate modern conveniences. In erecting works, one of the most important considerations, and in many cases a vital one, is the matter of location. This must be made in reference to the receiving of the crude material and the shipment of the finished product. The most fortunate establishments are those which have direct communication with rail and water transportation, or are connected with the competing lines of railway. In designing a manufactory, the old question arises of what is or is not unnecessary finish. It is the same question that is constantly coming up in relation to the finishing of machinery. A factory of the plainest and cheapest materials will furnish a shelter for the workmen, and in many lines business can be successfully carried on in a very poorly constructed shop. But is the amount of extra cost of finishing a building in an ornamental manner an absolute loss? It has been decided in case of machinery that extra finish is not a loss, because the beauty of the machine aids in selling it, even if it is of no practical use in its operation. There doubtless is a middle ground between extravagant ornamentation and absolute plainness, which may be advisedly taken.

Of course the dimensions and form of the works must conform to the requirements of the business to be undertaken in them. But a certain amount of beautifying can be advantageously done without incurring very much more cost than by building plainly. Thus, caps may be constructed over the windows almost as cheaply as without them. Pilasters may be run up with the walls, adding little to the expense, but very much to the beauty of the building, and at the same time strengthening the walls at the points where the beams are inserted. It does not require many such departures from an absolute plain exterior to make an attractive building. If the works are extensive, or if they form part of a system of town construction, as in the case of the Pullman works at Pullman, Ill., then it would not be considered either extravagant or unwise to invest a considerable sum in exterior finish and diversity of design. It must not be forgotten that buildings often have a worth separate from their use—that finely constructed works will sell for more, and more readily too, than though they were but plainly and cheaply made. In planning a machine shop, provisions ought to be made for doing the heaviest work on the lower floor, while the whole structure should be made to stand the severest strains which the operation of the business would be likely to subject it to. The ground floors, in particular, should be made as solid as it is possible to make them. Opinions differ as to how this may best be done. Some think that by embedding the floor timbers in and laying the floors on a solid body of concrete makes the best flooring, while others believe in different plans. A very superior way may be found by filling in between the cross timbers with cinders, when they can be obtained, and after tamping them down smooth, to lay thereon a floor of heavy plank. What is needed is a firm and substantial floor for the heavy machinery, which is thus provided. The hight of stories is another important matter. The experience of good builders demonstrates that 14 feet between the floors is a good average hight. Twelve feet is about as high as a man can throw a belt to advantage, and if the hangers are higher than that, he is constantly bothered in fixing his belts. Fourteen feet is high enough for proper ventilation and light. There should be plenty of light, and for this purpose where from the nature of the building, a window could be placed as often as once in 8 feet it would be desirable to have them so placed. That leaves 4 feet for windows alternating with 4 feet of wall. As to the width of shops, of course, plans will vary somewhat. Some make them 50 feet wide, while several recently constructed shops have been only 40 feet in width. Perhaps a fair average width may be placed at 45 feet, which allows of ample room for the placing of machines, and operating them to the best advantage. The upper floors of the shop must be substantially made, and how best to do this is no easy question. Some put up 2 by 12 or other sized joist, staying them with cross pieces, thus leaving the under side exposed, which makes an ugly looking, dirt-catching ceiling, besides being unhandy for affixing hangers or main line shafts. The best way to make a solid and substantial floor for the above purposes, is to lay 2 by 4 scantlings on the beams and spike them close together. Plane the scantlings on three sides and leave them beaded at the bottom; on the top of the scantlings inlay a covering of inch boards. This is a plan in vogue among many eastern manufacturers. The most desirable way for placing the beams is to have them 8 feet from center to center. This brings them the right distance apart for affixing the hangers and line shafts, at least in ordinary shops employing 2-inch shafts—the size in common use. It is well to locate the boiler house outside of the main building so that in case of explosions, the whole building will not be blown up. The chimney stack should also be run up independent of the building, because when made a part of the main building, it will settle by reason of its extra weight, thereby cracking and disfiguring the works. Modern chimneys are erected with hollow walls, providing an air space which effectually prevents cracking. They are also made with the hole largest at the top. Whoever thinks it an easy task to construct a machine shop will find that he is mistaken. He will find that those things which seem most simple require a great amount of care, research and experiment. But the improvement now being made in machine shop construction will materially aid him in his labors, by furnishing both plans and suggestions for his work.

The Lesson of the Morrell Fire.

The burning of the Morrell storehouse has drawn much belated wisdom from the New York daily journals, on the subject of fire-proof construction, and judging from the accounts of the mode in which that particular building was planned, it is quite time that the public should be enlightened in regard to such matters. Situated, as the Morrell storehouse was, on the opposite side of a narrow street from an enormous stable, it was not only pierced with many and large openings on that side, but these openings were totally unprovided with shutters, while a huge wooden sign secured to the wall facing the stables offered an admirable means for attracting the fire across the street, and ensuring the rapid communication of the flames along the whole front. The interior had once been divided into sections by brick walls, but many openings had been made, and there was practically no check to the spreading of the conflagration within the building. Evidently, the "absolute security" which its owner claimed for it was a mere pretence, without any reasonable foundation and it is surprising that business men, who must have known something of the scientific and substantial mode of erecting such structures, as seen in the warehouses used by importers in the lower part of the city, should have been found willing to leave their property in it. For the future, the owners of valuable pictures, jewels or furniture will probably endeavor to find storage in fire-proof buildings, and as the demand is very likely to be met by the simple process of putting up the sign "Fire-proof" on structures which would not resist a conflagration for ten minutes, it cannot be too often repeated that few and narrow openings to the exterior, and subdivision of the interior space by floors and partitions through which fire cannot rapidly make its way, form, in conjunction with efficient supervision, the essential and not very costly requisites of a construction in which such a catastrophe as that here referred to would be impossible. More might be done; it is practicable to build a warehouse such that if a fire were kindled in every room but one, and allowed to rage at will until all the fuel within reach was consumed, the goods stored in that one room would remain uninjured, and the building itself would not be in the least impaired; but so long as insurance can be obtained at present rates, it is hardly probable that the art of fire-proof construction will be carried beyond its rudiments unless in exceptional cases.

Iron Mining in the United States.

A preliminary report upon the production of iron ore in the United States during the year ending June 1st, 1881, has been prepared by Mr. Raphael Pumpelly, special agent of the Census Bureau. The total product in the United States was 8,022,398 tons, of 2,000 pounds, the States from which it was obtained being as follows:

	Product in tons of 2,000 pounds.	*Per cent of total product.*	*Per cent of total value of product.*
Pennsylvania	2,173,415	27.09	22.57
Michigan	1,834,712	22.87	26.27
New York	1,239,959	15.46	15.23
New Jersey	799,545	9.97	13.82
Ohio	604,241	7.53	5.92
Missouri	386,197	4.81	7.28
Alabama	191,676	2.39	.879
Virginia	170,099	2.12	1.675
Maryland	138,709	1.73	1.855
Tennessee	104,465	1.30	.641
Georgia	91,416	1.14	.625
Kentucky	64,809	.808	.722
Massachusetts	62,637	.780	.984
West Virginia	60,371	.752	.386
Wisconsin	41,440	.517	.318
Connecticut	35,018	.437	.643
Oregon	6,972	.087	.020
Maine	6,000	.075	.039
Texas	3,600	.045	.035
North Carolina	3,318	.041	.023
Delaware	2,726	.034	.029
Vermont	560	.007	.012
Indiana	513	.006	.004
Total United States	8,022,398	99.999	100.000

It will be seen that Pennsylvania heads the list, and that very nearly half the entire product of the country was obtained in Pennsylvania and Michigan. A list of mines which produced over 50,000 tons shows that the famous Cornwall ore bank held the front rank, its product being 280,000 tons. The mines which followed next in order were the Republic in Marquette county, Mich., with a product of 240,000 tons; the mine of the Lake Superior Iron Co. in Marquette co., Mich., with a product of 215,930 tons; the Norway and Cyclops new mines in Menominee county, Mich., with a product of 210,875 tons; and the old bed in Essex county, N. Y., with a product of 208,416 tons. No other mine reported produced $200,000 tons.

Glass.

Traulionie gives the tensile strength of glass at from 2,500 to 9,000 pounds per square inch, according to kind; crushing strenth, 6,000 to 10,000 pounds per square inch; transversely, by his own trials, Millville (N. J.) flooring glass, one inch square, and one foot between the end supports, breaks under a certain load of about 170 pounds, consequently it is considerably stronger than granite, except as regards crushing, in which the two are about equal. It is suggested that glass will shortly be used for many purposes where other and much inferior materials are still exclusively employed. Glass may be used as water conduits to better advantage than cast-iron or terra cotta, as it is impervious to moisture and proof against corrosion or chemical action. It is already considerably in use for flooring, and it has lately been successfully experimented with for railway sleepers under exceptionally severe conditions.

Home Department.

The Use of Zinc for Lining Water Cisterns.

There has been some discussion as to the deleterious effect of zinc upon water for drinking purposes; some taking the ground that it is comparatively harmless, and others that it is sufficiently hurtful to condemn its use for that and similar purposes. The New York City Board of Health has taken the latter view of the case, and in their lately published set of rules for plumbing work in dwelling houses and other buildings, occurs the following:

"Cisterns for drinking-water are objectionable; if indispensable, they should never be lined with lead, galvanized iron or zinc. They should be constructed of iron or of wood, lined with tinned copper. The overflow should be trapped, and should discharge into an open sink—never into any soil or waste pipe or water-closet trap, nor into the drain or sewer."

It would be interesting to know the facts upon which the Board base their condemnation of the use of galvanized iron or zinc. In the year 1874, Dr. M. E. Boardman, of Boston, at the instance of the Massachusetts State Board of Health, one of the most active and scientific public bodies of its class in the country, made a careful and exhaustive examination of the question of the safety of using zinced iron for the storage and conveyance of drinking-water. His paper, entitled "On the Use of Zinced or Galvanized Iron for the Storage or Conveyance of Drinking-Water," is published in the annual report of the Board for the year 1874, and is a very able and masterly review of the whole subject. Dr. Boardman, as the result of his examination of the subject, and of a large number of authorities who have investigated it, considers it to be proved theoretically, experimentally and practically that zinc is not acted on by ordinary drinking-water; that water allowed to stand in reservoirs or drawn through pipes of zinc or galvanized iron, usually contains an appreciable amount of zinc, more or less according to various influences; that the zinc contained in the water is in the form of undissolved oxide and carbonate, and of dissolved salts, the exact nature of the latter not being known; that probably under no circumstances is the oxide or carbonate an active or gradual poison, much less in the amounts in which they can occur under the conditions mentioned; that, at least with water fit for drinking purposes in other respects, the contained zinc salts in solution do not exert any deleterious effects upon the human system; and, finally, that even if all the zinc in solution were in the form of the chloride which is known to be the most active poison of the zinc salts, the amount would still be insufficient to endanger health.

The examination and study of the subject by Dr. Boardman, upon which he bases these conclusions, appear to us to be convincing, the only evidence of the unfavorable or hurtful character of zinc for the above mentioned purposes, being of an isolated and doubtful character. It may be well, however, to add that the Massachusetts Board, while giving Dr. Boardman's paper in full, in a very conservative manner say, in reference to his conclusions: "The Board is not prepared to give a positive opinion, or to declare that zinced iron is, under all circumstances, and with all persons, harmless." Until some positive and reliable evidence is accumulated to offset and contradict the very convincing facts and inferences of Dr. Boardman, we are of the opinion that his conclusions represent most correctly our best knowledge of the subject under discussion; and until the New York Board of Health present such facts, we must dissent from their condemnation of zinc for storing or conveying drinking-water.

Temperament.—Dr. B. W. Richardson, the well known English authority on hygiene, referring in a recent lecture to the divisions of temperament established by Hippocrates and Lord Bacon, said that his own division was into the sanguine, which he associated with the Celtic race, the nervous, which characterized the Saxon race, the bilious, which showed itself in Eastern or Semitic blood, and the lymphatic, which was noticeable in the Northern or Scandinavian kind. He believed the time would come when the schoolmaster would be able to classify his scholars by a study of their temperaments, and gave some practical hints as to the particular modes of dealing with children distinguished by the temperaments to which he had referred.

Rogers' Latest Group.

Our illustration represents the latest of the admirable groups of statuary by Rogers which have become so popular throughout the country. Mr. Rogers, by these admirable productions, which are sold at prices that place them within the reach of persons of moderate means, has contributed very largely to the cultivation of the artistic taste among our people. His groups are designed with true artistic feeling, for the subjects in most instances tell some homely story, depict some touching theme of home-life, or narrate some stirring episode from the history of our country. They show that he has the true inspiration of the artist, and the popularity they have achieved is well deserved. They have added to the enjoyment of thousands of the households throughout the land which they have adorned.

"FETCHING THE DOCTOR."

Mr. Rogers' latest production, of which we give an illustration—like all the others—tells its own story; "Fetching the Doctor" in hot haste, through the night and storm, to the bedside of some loved one stricken with sudden illness, or perchance in the last hour of mortal agony.

Concentration in Business.

Successful business men are of a conservative nature. Like skillful generals, they mass their forces in solid columns instead of thinning ranks in trying to cover a wide area of ground. Solid battalions resist successfully the fierce onslaughts of the enemy and win the day, while weak columns go down at the first charge of the bayonet. Merchants who concentrate their energies and talents upon their legitimate business calling, and let outside matters alone, keep their affairs well in hand, and are therefore fortified against sudden disaster. When they, however, begin, in addition to selling merchandize, to go into outside speculations, they force and try to cover too much ground. A merchant cannot run a store and farm safely side by side; either the one or the other will suffer. Dry goods and silver mines do not mix well together when the same hand guides both. A collision detrimental to one or both interests will sooner or later occur. A manufacturer should not attempt to raise sheep because he uses their fleece in his mills. His business is to see that out of every pound he buys he turns out as many yards of goods as it is possible to do and produce a good fabric. Here is enough to occupy his time profitably, without buying land and going into sheep husbandry. With many business men the trouble is not so much in making money, as to keep it when it is made. They are of a restless temperament, never satisfied, always on the *qui vive*, eager for speculation, and ready to dabble in outside ventures. They speculate in stocks, take a venture in grain or pork, risk largely in wool or cotton, and are always willing to subscribe handsomely for the shares of gold or silver mines. Such men lack the power of concentration. With divided mind, divided energies, and divided capital, they are scattered over too wide a surface, and at the first wave of a panic they go down into insolvency and financial ruin.

Not so the business man who steadily pursues his legitimate occupation. He husbands his resources of energy and capital, he gathers renewed strength with the profits of every year, he looks ahead for breakers, and is fortified with a good bank account when disaster threatens the commercial world.

Ventilation of Closets.

There is nothing so handy in a house as an abundance of large, roomy closets; but because they are handy and extremely useful, they are apt to be abused. There are many things which, as a matter of course, are always put into a closet, of which the articles of outward wearing apparel make a large part. There are also things which ought not to go into a closet—that is, a closet adjoining or closely connected with a living or sleeping room. Of such are all soiled undergarments—the wash clothes—which should be put in a large bag or a roomy basket, and then placed in the wash-room, or some other well aired room at some distance from the family rooms. Having thus excluded one of the fertile sources of bad odors in closets, the next point is to see that the closets are properly ventilated.

It matters not how clean the clothing in the closet may be, if there is no ventilation that clothing will not be what it should be. Any garments, after being worn for awhile, will absorb more or less of the exhalations given off from the body, and will thus contain an amount of foreign—it may be hurtful—matter, which free circulation of pure air can soon remove; but if this is excluded, as in many close closets, the effluvia increases, and the clothes, closets and adjoining rooms in time possess an odor that any acute sense of smell will readily detect.

Every closet in daily use in which the night clothes are hung by day and the day clothing by night, should have an airing as well as the bed. If the closet be large enough to admit of a window—and it is in some cases—an ample provision for sunlight and a circulation of pure air is provided in the window, which should be left open for a short time each day.

In the case of small closets, a ventilator could be put over the door, or even in it. In many cases such provisions for pure air are not practicable, and the next best thing is to see that the door of the closet is left open for half an hour or so each day at the same time the windows are thrown up and the large room is purified with fresh air from out of doors. In this way—first, by keeping out clothes intended for the wash, and second, daily changing the air—the closets may be kept in comparatively good condition.

Removal of Grease Spots.—Whenever oil of turpentine, benzole or ether are used to remove grease spots on cloth, the application should be made on the reverse side of the cloth by moistening it with the solvent in a circle surrounding the spot, so as to approach it gradually, having blotting paper in contact with the spot of grease to absorb the fat immediately; otherwise the solvent will have the effect of spreading the grease over a larger surface instead of driving it out of the cloth. In the application of a hot iron to one side and blotting-paper to the other, the heat will drive the grease out of the cloth into the paper, because the fat has a tendency to move from the hotter parts towards the cooler.

Sunlit Rooms.

No article of furniture should be put in a room that will not stand sunlight, for every room in a dwelling should have the windows so arranged that sometime during the day a flood of sunlight will force itself into the apartment. The importance of admitting the light of the sun freely to all parts of our dwelling cannot be too highly estimated. Indeed, perfect health is nearly as much dependent on pure sunlight as it is on pure air. Sunlight should never be excluded except when so bright as to be uncomfortable to the eyes. And walks should be in bright sunlight, so long as the eyes are protected when inconveniently intense. A sun bath is of more importance in preserving a healthful condition of the body than is generally understood. A sun bath costs nothing, and that is a misfortune, for people are deluded with the idea that those things only can be good or useful which cost money. But remember that pure water, fresh air and sunlit homes, kept free from dampness, will secure you from many heavy bills of the doctors, and give you health and vigor which no money can procure. It is a well established fact that the people who live much in the sun are usually stronger and more healthy than those whose occupations deprive them of sunlight. And certainly there is nothing strange in the result since the same law applies with equal force to nearly every animate thing in nature. It is quite easy to arrange an isolated dwelling so that every room may be flooded with sunlight some time in the day, and it is possible that many town houses could be so built as to admit more light than they now receive.

Seal and Sea-Otter Skins.

At a recent meeting of the Polytechnic Association of the American Institute, the president, Mr. Thomas D. Stetson, gave an abstract of a preliminary report by a special agent of the United States Census Bureau, showing that the total number of seal skins and sea otter skins taken on our Pacific coast during 1880 was close to 160,000. Of sea otter, having an average value of $50 per skin, there were 3,500 captured in Alaska and 75 in California. Of the fur seal there were taken in Alaska 147,000, valued at $10 each; in Washington Territory, 6,000; and in California, 2,000, valued at only $5 per skin. The total value in first hands is about one and three-quarter million dollars. The total capital invested, excepting Indian canoes and material, which he made no attempt to value, is about three-quarters of a million dollars.

Mr. Macdonough described an artificial construction of silk having a pile very closely akin to fine fur. It was made as a double fabric, thickly set threads connecting the two being afterwards divided by a knife running like a belt saw.

The President described Astracan cloth, an imitation fur of worsted or other materials, having long pile on one side. He believed all such fur was liable to pull out from the fabric.

Mr. Chapman suggested a cement of rubber, or the like, to be applied on the back for holding the fibers securely.

GLUES THAT TAKE THE LONGEST TO DRY are to be preferred to those that dry quickly, the slow drying glues being always the strongest, other things being equal. Never heat made glue in a pot that is subjected to the direct heat of the fire or a lamp. All such methods of heating glue cannot be condemned in terms too severe. Do not use thick glue for joints or mortises. In all cases work it well into the wood in a similar manner to what painters do with paint. Glue both surfaces of your work.

TOOTHACHE.—There should be a remedy for toothache in every house where there are children. The following is reported by medical authority as reliable: Take of carbolic acid (saturated solution), chloral hydrate (saturated solution), paregoric, fluid extract of aconite—of each one ounce; oil of peppermint, half an ounce; saturate a piece of cotton and pack tightly in the cavity.

Gas and Oil Stoves.

The rapidly increasing use of gas and oil stoves for heating and cooking must have been noticed by every observant person. While a few years ago they were practically unknown, they are now in common use, and their introduction is steadily growing as their convenience and utility become more generally understood and appreciated.

For heating purposes, stoves of this description have the great merit that they can be instantly ignited when required, without the slow and troublesome process required to start a coal fire; and when not needed, they can be instantly extinguished. On these accounts, they have become deservedly popular; on the score of convenience, and on the score of economy, even where the city gas is used at the high figures that rule, the fact that the gas can be turned on or off at will, thus obviating the wastage that is one of the grave objections of coal fires, (which must be kept up day and night), they are found in the long run to be quite as cheap, or even cheaper, than coal fires.

The rapidly growing introduction of stoves adapted for burning gas, must sooner or later induce the gas companies to cheapen the cost of their gas, for with this encouragement the consumption would doubtless be increased manyfold. In any event, the gradual introduction of water gas for fuel, which is making progress, will compel them to do so.

Of the convenience and economy of kerosene for heating purposes, it is unnecessary to speak. Several very practical forms of stoves designed for heating with gas and oil have lately been brought to our notice by the maker, James L. Sharp, of No. 10 Murray street, this city, which appear not only well adapted to their intended uses from a mechanical point of view, but which are likewise attractive and ornamental in design. For burning kerosene, the stoves are provided with an oil-heating drum, with which the complete combustion of the oil is effected, and its full heating effect obtained, without the production of the odor, which is one of the unpleasant features of most of the oil-burning stoves in the market.

Miscellaneous and Advertising.

To make paint dry quickly, use a large proportion of Japan varnish in mixing for use.

W. F. & John Barnes, of Rockford, Ill., have commenced the manufacture of power lathes, in addition to that of foot lathes.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of 64 pages. Published by Jas. F. Hotchkiss, 84 John street, New York. Mailed free to any address.

Parties needing wood-working machinery, engines, boilers, etc., should communicate with Symmes & Perine, of 84 Pike street, New York. They have a choice and varied stock, to which they are adding constantly.

The Henry R. Worthington Hydraulic Works, of 239 Broadway, New York, have issued a new illustrated catalogue of 26 pages, containing illustrations and descriptions of the various improved pumping machines manufactured at their works.

The Babcock & Wilcox Company, of 30 Cortlandt street, this city, whose water-tube steam boilers have come into such general use throughout the country, have recently opened an office and salesroom in Boston. This is the third city, besides New York, in which this company are represented, their other offices being in Philadelphia and Chicago.

Stead's circulating generator and feed-water heater is employed in many of the largest establishments in the country, including the works of John A. Roebling's Sons & Co., at Trenton, N. J.; Lowell M. Palmer's barrel factory in Williamsburg, N. Y.; the Western Union Telegraph building; the United States Assay office in Wall street, New York, and in many other prominent places. The economy and gain resulting from the use of Mr. Stead's attachments commend them to the attention of all steam-users.

There is probably no class of machines in which there have been greater improvements during recent years, than in hoisting engines, and so indispensable have they become to contractors, builders, miners and others having lifting to do, that a great demand has been created, and there are several firms who devote exclusive attention to their manufacture and sale. Notable among these we may mention Copeland & Bacon, of 85 Liberty street, this city, who make a great variety of styles of Bacon's celebrated hoisting engines for railroads, bridge building, pile driving, contractors, quarries, mining and other uses. These machines are giving the best satisfaction wherever employed, and the manufacturers are finding for them a constanly growing sale.

Cottage Design.

Our recent publication of cottage designs especially adapted to the wants of persons of limited means and cultivated taste, has evidently stimulated the demand for houses of this class; and it is at the earnest request of many of our patrons that we have procured for this issue another of Mr. Knapp's admirably arranged cottages. We regret that a want of time prevented its perspective representation, as many are unable to appreciate from the geometrical drawings the picturesque variety of outline and the effective play of light and shade presented in its finished perspective. It will be readily observed, however, that the best results have been attained by the simplest and most economical means, and that every attractive feature is an expression of constructive necessity or important utility.

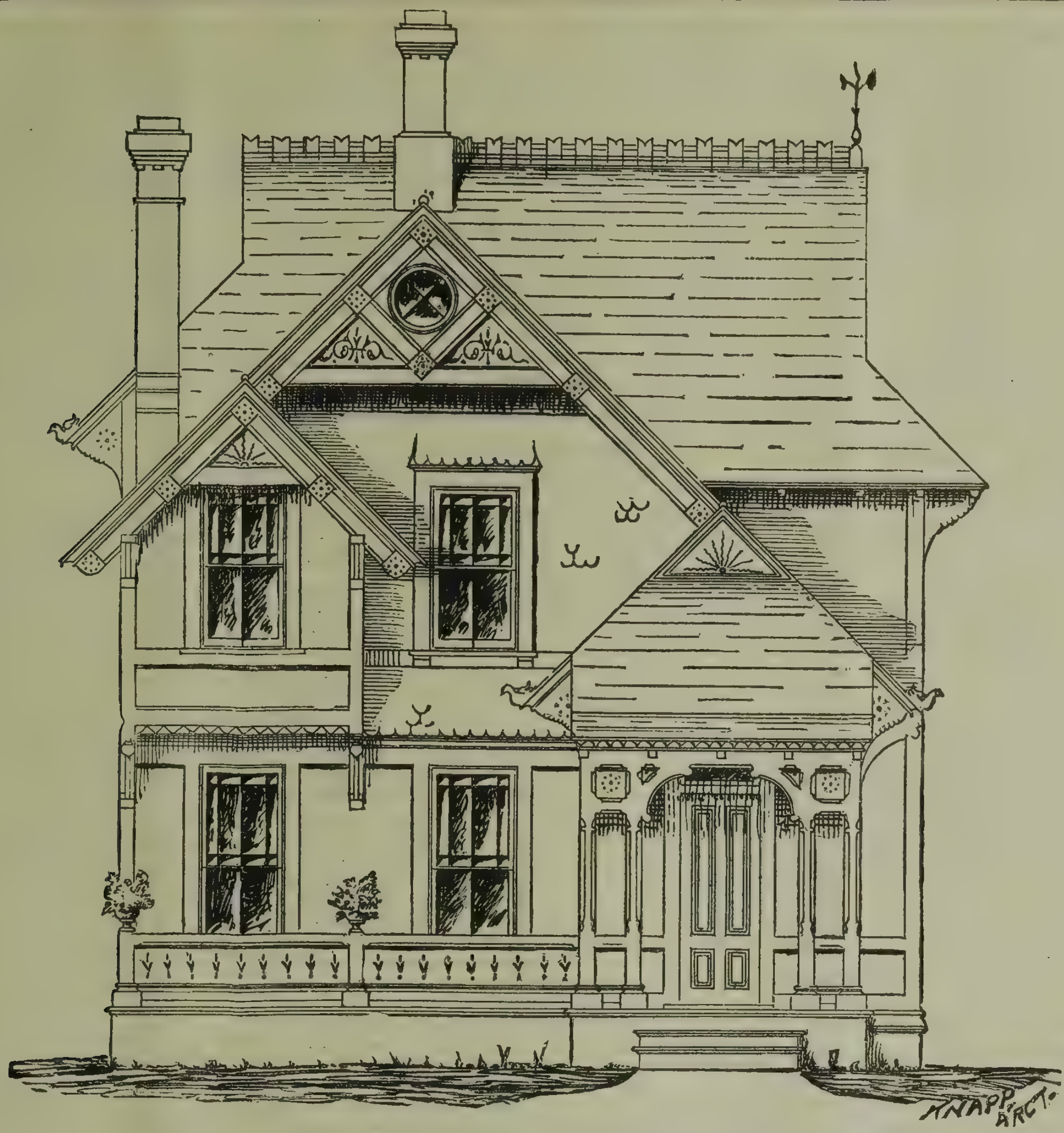
The arrangement of the plan is strikingly compact and convenient, the disposition of the timbers advantageous, and the external and internal details simple and effective.

The accommodations, it will be noticed, consist of a parlor, dining-room, kitchen and three chambers, all the rooms being of good size, and of convenient access and pleasant communication. The ground plan is unbroken, except by the dining-room bay-window; but the sky line is considerably varied and attractive.

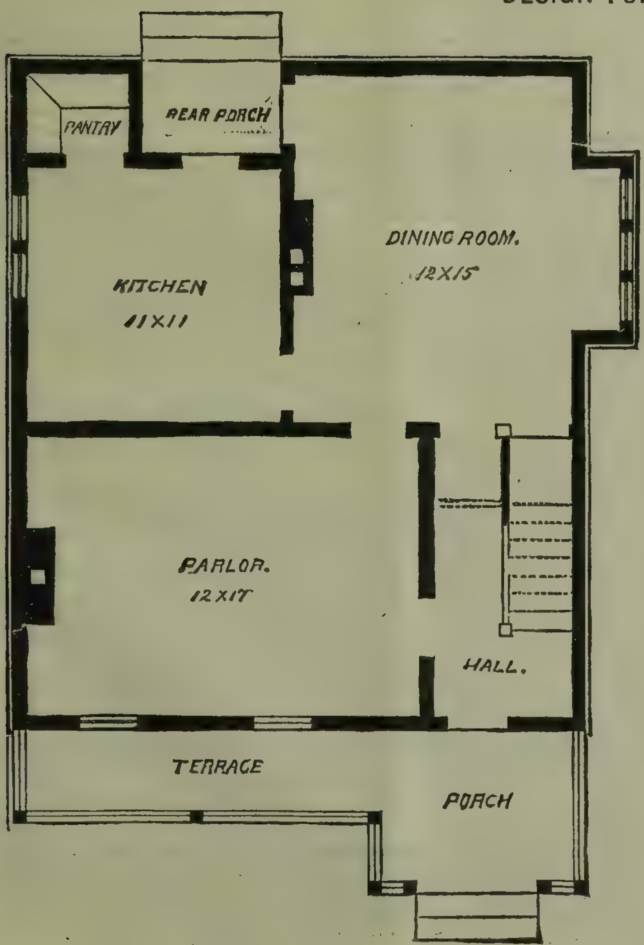
The diversified character of the exterior details affords a fine opportunity for the exercise of taste in painting. This important part of the work should not be left to an ignorant painter or any person not thoroughly acquainted with the laws of harmony and contrast. Buildings of this character are peculiarly susceptible of the embellishments of color, and much of the beauty of design may easily be either destroyed or enhanced by the paint brush.

This cottage is to have a cellar extend under the entire building, and finished 6 feet 6 inches in the clear. The outside cellar steps are near the rear porch. The inside cellar stairs are underneath the main flight. The hight of the first story is 9 feet 6 inches; second story, 9 feet. The inside finish of the several rooms is consistent with the general character of the design, being in many features unique and effective.

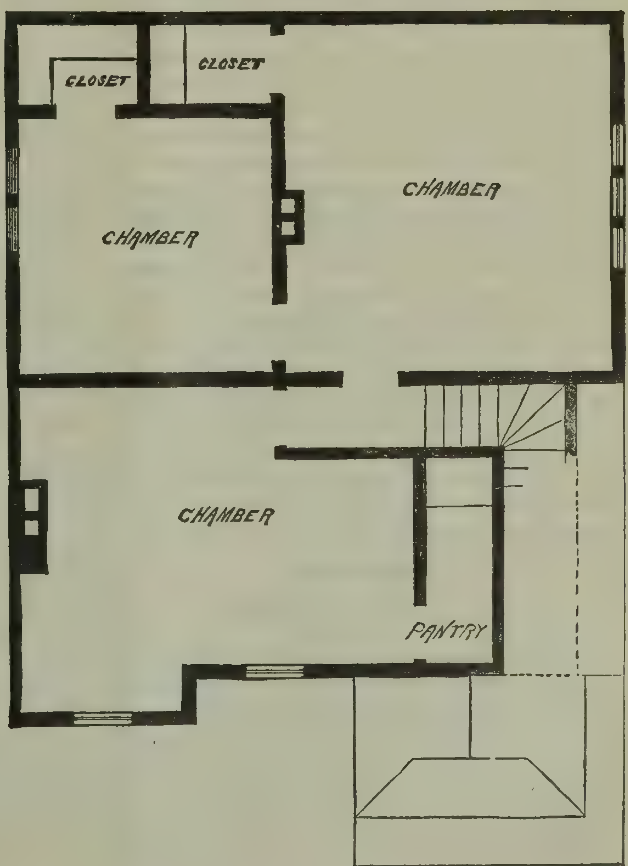
By some slight modifications, which readily suggest themselves, this design can be made to suit the varied requirements of many. An extension may be carried out in the rear, the modern improvements introduced, and a more spacious arrangement secured without materially affecting the beauty of the design. The plan is particularly adapted to a western aspect, and the building can be finished complete, without plumbing, for about $1,500. Mr. Horace G. Knapp, of 61 Broadway, New York, is the architect.



DESIGN FOR COTTAGE, COSTING $1,500.



FIRST FLOOR.



SECOND FLOOR.

Alum in Manufactures.

Alum renders two important services in manufacture—as a mordant and as a size. In the former capacity it is used in printeries and dye works, and both English and American varieties are employed. In its other capacity it serves as a size for paper. The two common varieties of alum are distinguished by their methods of manufacture, as "potash" alum and "ammonia" alum. The latter cannot be used by paper manufacturers, because the ammonia in the alum and the chlorine in the bleaching powders unite and produce such an offensive odor as to prevent the operatives from working in the establishment. Potash alum may be utilized for paper sizing, but is not to any great extent, for the reason that more efficient substitutes have been discovered. The sizing property in alum is furnished by sulphate of alumina, and this is contained in a greater degree in a number of prepared alums which paper-makers now generally use. In sizing paper, there are two kinds of size employed—animal size, prepared from hide cuttings, and rosin or "engine" size, which we propose to treat of in this article. Rosin size is obtained by boiling rosin with carbonate or caustic soda, the result being a chemical compound in which one or both of the rosin acids (sylvic and pinic) are combined with soda, the alkali forming a neutral substance—"size." If a solution of sulphate of alumina be added to a solution of size, a chemical decomposition takes place, the result being a solution of sulphate of soda and a solid precipitation of aluminous compound. If the sulphate of alumina and the size be mixed in their equivalent quantities, the whole of the alumina in precipitated, as well as all the effective material in the size, and the sulphate of soda goes to waste. The rosin acids are removed from a state of solution, and are precipitated in combination with alumina into the paper stock. This combination and precipitation of the rosin acids and the alumina carries down any coloring or fine solid matter, if present in the rag engine, and fixes it in the fiber of the paper pulp. Hence the necessity for size. It is evident that on the amount of soluble alumina it contains depends the value of the size. Paper manufacturers generally make use of two brands, the "natrona porous" alum and the "pearl" alum. The basis of the former is a mineral found in Greenland, called "cryolite." The whole of this product is taken by two firms, one in this country and the other in Germany. The alumina is precipitated and treated with sulphuric acid, and the result is claimed to be pure sulphate of alumina and water. Such brands are used more particularly on the better grades of news and book papers, and even in recent years on writing papers. Engine sizing is on the increase. In Germany writing papers are sized entirely in this way; but the method generally employed in this country is to first engine-size and afterwards apply the animal size, which, as we said above, is made from hide-cuttings. The great bulk of these cuttings are obtained from England. When animal size only is applied to writing papers, it has been found that the surface of the paper is coated merely; but where engine sizing is employed, the size fills the paper and gives it a firmer body. Aluminous cake is a cheap quality of alum, which contains some sediment and some free acid. It is used in sizing low grades, such as ordinary news and Manilla paper.

What Constitutes an Editor.

Editor Watterson, in the Louisville *Courier-Journal*, speaks as follows about conducting a newspaper: "Some people estimate the ability of a periodical and the talent of its editor by the quantity of its original matter. It is comparatively an easy task for a frothy writer to string out a column of words upon any and all subjects. His ideas may flow in one weak, washy, everlasting flood, and the command of his language may enable him to string them together like bunches of onions, and yet his paper may be but a meager and poor concern. Indeed, the mere writing part of editing a paper is but a small portion of the work. The care, the time employed in selecting, is far more important, and the fact of a good editor is better shown by his selections than anything else; and that, we know, is half the battle. But, we have said, an editor ought to be estimated, his labor understood and appreciated, by the general conduct of his paper—its tone, its uniform, consistent course, aims, manliness, its dignity, and its propriety. To preserve these as they should be preserved is enough to occupy fully the time and attention of any man. If to this be added the general supervision of the details of publication which most editors have to encounter, the wonder is how they find time to write at all."

New Publications.

The Encyclopædia Britannica; a Dictionary of Arts, Sciences, and General Literature. Ninth edition, (American reprint). Vol. XII. Philadelphia: J. W. Stoddart & Co. 1881.

The twelfth volume of this standard encyclopædia fully maintains its universal reputation as the most complete and authoritative work of reference in the English language. We can do no better in noticing it, than to refer to a few of the more important subjects embraced in its contents. For this purpose we select the following: *Histology* (animal), by Prof. E. A. Shaefer, F.R.S., University College, London; (vegetable), by W. R. McNab, M.D., Professor of Botany, Royal College of Science, Dublin. *History*, by J. Cotter Morrison, M.A. *Homer*, by D. B. Monro, M.A., Vice-Provost of Oriel College, Oxford. *Homestead*, by E. P. Hanna, Department of the Interior, Washington, D. C. *Honduras*, by E. G. Squier, author of "Notes on Central America. *Horse* (zoölogy and anatomy), by W. H. Flowers, F.R.S., Professor of Comparative Anatomy, Royal College of Surgeons, London; History, Management, Horsemanship, by E. D. Brickwood, London; Racing, by E. D. Brickwood, London; Maj. J. R. Hubbard and W. T. Chester, New York. *Horticulture*, Principles, by M. T. Masters, F.R.S.; Practice, by T. Moore, Botanic Gardens, Chelsea; Calendar for the United States, by Peter Henderson, Jersey City, N. J. *Husband and Wife*, by Edmund Robertson, Professor of Roman Law, University College, London. *Hydrogen*, by H. E. Armstrong, F.R.S., Professor of Chemistry, London Institution. *Hydrophobia*, by Dr. J. O. Afflock. *Hygiene*, by Prof. F. de Chaumont. *Idaho*, by Henry Gannett, Department of the Interior, Washington. *Illumination*, by H. B. Wilson, British Museum. *India*, by W. W. Hunter, LL.D., Director-General of Statistics to the Government of India. *Indiana*, by A. C. Harris, Indianapolis. *Indian Ocean*, by W. B. Carpenter, M.D., F.R.S. *Indians* (American), by A. H. Keane, editor of "Early Teutonic, Italian and French Masters," and Henry Gannett. *India Rubber*, by E. M. Holmes and Thomas Bolas, F.C.S. *Indigo*, by James Paton.

The above very imperfect selection of topics affords a slight idea of the value of the contents of the volume, which embraces 888 pages of closely printed text. The American publishers are issuing the work in the most careful manner; the typography is unexceptionable, the maps and other illustrations excellent, and the binding substantial.

Malaria: What it Means, and How Avoided. By Joseph F. Edwards, M.D. Philadelphia: Presley Blakiston. 1881.

This little treatise from the pen of an author well known as the writer of several very sensible and practical works on medical subjects, containing much sound advice to laymen, is worthy of much praise, and should be widely circulated and read. In his first chapter, Dr. Edwards discusses the nature of malaria, and clears up the misapprehensions surrounding the word by reason of what he regards to be its improper use. He defines it to be simply what its derivation would make it appear to mean—namely, *mal aria*, bad air. According to the author's definition, the air may be rendered unwholesome by the presence of a great variety of impure elements, which elements are capable of producing various disordered and unhealthy conditions of the system. In one instance, the impurity (malaria) may be of such a nature as to give rise to the phenomena of chills and fever, in another to cholera, in a third to smallpox, in a fourth to diphtheria, and so on. In each of these cases, it is necessary that some particular impurity should be present in order to give rise to a special disease. This definition has the great merit of simplicity, and so far as we are able to form an opinion, conforms to the facts as far as these have been ascertained.

The succeeding chapters deal successively with the topics—Where is Malaria Found? the Symptoms of Malaria; and How to Avoid Malaria. They abound in terse and vigorous presentations of the dangers attending living in improperly drained and ventilated houses, and of permitting the accumulation of decomposable organic matter of any description in the neighborhood of the dwelling house. He proposes the universal substitution of granite or asphaltum roadways in our cities, and the thorough flooding of the same during the small hours of the morning from the fire plugs, for cleansing them and the sewers of all accumulations of malaria-breeding filth. He gives a sketch of the evils of careless habits of living; of the healthy home and the disease-breeding one. Taking it as a whole, the book is an eminently sensible and practicable one, and may be read with profit by many who think themselves "up" in sanitary matters, and by all who are not, but should be.

The Photographic Amateur. A Series of Lessons in Familiar Style for those who desire to become Practically Acquainted with this Useful and Fascinating Art. By J. Traill Taylor, Editor "Photographic Times," etc. New York: Scoville Manufacturing Co., 419 and 421 Broome street, W. Irving Adams, Agent. 1881. Price, 50 cents.

The above work forms an octavo volume of 96 pages, devoted to the systematic explanation of the more important and useful methods employed in photography, and to a series of concise instructions to enable the amateur photographer to put these methods into practice. Of late years the machinery and paraphernalia of the photographer have been much improved and simplified, and the portable photographic outfits that the tourist or explorer may now command, and the simplicity and certainty with which they can be employed, even by those who have little or no practical acquaintance with the art, have given an enormous extension to the cultivation of photography. The present volume is issued by one of the largest manufacturers of photographic supplies, and has been carefully prepared by an expert in photography, who is well known to the members of the profession as one of the leaders in photographic journalism. He has succeeded in embodying in the work every essential particular in relation to the practice of photography by the various methods in vogue, in the form of instructions that are as simple and comprehensible as the subject will permit. By following these instructions, any person of ordinary intelligence will be able, with little difficulty, to produce pictures that will be a source of much gratification.

The Mechanics Slide-Rule, and How to Use it. Being a Compilation of Explanations, Rules and Instructions Suitable for Mechanics and others interested in the Mechanic Arts. Compiled and Arranged by Fred. T. Hodgson. New York: Industrial Publication Company. 1881. Price, 25 cents.

This very useful manual is designed by its author to give to American mechanics, and especially to beginners, a thorough knowledge of this very useful instrument, the capabilities of which are but imperfectly understood. This he has striven to do by presenting a compilation of instructions and rules of a practical and readily comprehensible nature, in which the uses and applications of the instrument are plainly set forth. The manual contains rules for the measurement of all kinds of boards and planks, timber in the round or square, glaziers' work and painting, brick-work, pavers' work, tiling and slating; the measurement of vessels of various shapes, the wedge, inclined planes, wheels and axles, levers, the weighing and measurement of metals and all solid bodies, cylinders, cones, globes, octagon rules and formulæ, the measurement of circles, and a comparison of French and English measures, with much other information useful to builders, carpenters, bricklayers, glaziers, pavers, slaters, machinists, and other mechanics.

Annual Report of the Regents of the Smithsonian Institution; showing the Operations, Expenditures and Condition of the Institution for the Year 1879. Washington: Government Print. 1880.

This volume, which we owe to the politeness of the able secretary, Prof. Spencer F. Baird, contains, in addition to its usual statement of the business operations of the institution, a lengthy history of James Smithson and his bequest; a highly interesting and valuable study of the savage weapons at the Centennial Exhibition, by Edward H. Knight, A.M., LL.D., profusely illustrated; numerous papers relating to the subject of human antiquities, and other matters of scientific interest.

The North American Review, although published by Messrs. D. Appleton & Co., is owned and wholly controlled by its editor. Messrs. Appleton & Co., in view of recent articles that have appeared in it, will decline to act as its publishers after the close of the present year.

OTHER PUBLICATIONS RECEIVED.

Annual report of the Chief of Engineers, United States Army. 1881.

Annual Report of the Secretary of Internal Affairs of the State of Pennsylvania, for the year ending November 30, 1880. Parts I. and II. Harrisburg: State Print. 1881. From Hon. James Gay Gordon, Philadelphia.

Summary Statement of the Imports and Exports of the United States, for the month ended August 31, 1881, and for the eight months ended the same, compared with the corresponding periods of 1880. Prepared and published by the United States Bureau of Statistics. [Corrected to October 16, 1881].

Quarterly Report of the Chief of the Bureau of Statistics, Treasury Department, relative to the Imports, Exports, Immigration and Navigation of the United States for the three months ended June 30, 1881; also containing other Statistics relative to the Trade and Industry of the Country. Washington: Government Printing Office. 1881.

Contributions to the Theory of Blasting, or Military Mining. By H. Höfer, Ordinary Professor at the Royal Imperial School of Mines at Prizbram, Part 2. From the Austrian "Zeitschrift für Berg-und Hüttenwesen," XXIX. 1881. Translated by Capt. Chas. W. Raymond, Corps of Engineers, U. S. Army, Instructor of Practical Military Engineering at West Point Washington: Government Printing Office. 1881.

Notes and Queries.

This department is intended to furnish, for the benefit of all our readers, information on any subject of a scientific or technical character falling within the field of THE MANUFACTURER AND BUILDER. *Any of our readers possessing additional or more correct information than that which we give relating to the questions, are cordially invited to communicate it to us for publication. We also request that all questions or answers be written on separate pieces of paper, and addressed to the Editor.*

QUESTIONS.

(2909) CONVERSION OF LIGHT NAPHTHAS INTO HEAVIER OILS.—Is there any method, or has any method ever been proposed, for converting the light petroleum oils into the heavier oils?—S. C., Greenpoint, L. I.

(2910) LAMPBLACK FROM NATURAL GAS.—I have read somewhere, either in your journal or another scientific paper, of the manufacture of lampblack from natural gas. Is this manufacture successful? How does the lampblack from gas compare with that made in the ordinary way?—S. C., Greenpoint, L. I.

(2911) WATER BATH OF HIGH TEMPERATURE.—I will thank you to suggest the best salt solution to use in a water bath, to give me an evaporating temperature of say 300° to 350° Fah.—H. G. Buffalo, N. Y.

(2912) THE METRIC SYSTEM OF WEIGHTS AND MEASURES.—In what countries is the metric system of weights and measures in use? Do you consider it the best system?—F. S., Dayton, O.

(2913) PREPARING SARDINES.—Can you give a proper description of how sardines are prepared for the market in France? or refer me to such a description?—W. J. T., Homosassa, Fla.

(2914) RITCHIE MINERAL.—What is the nature of Ritchie mineral? A reply in your next will oblige.—S. C., Greenpoint, L. I.

(2915) PUMP PROBLEM.—Suppose I had a pump with a piston, and it had a 10-inch stroke clear from the inside end to the face of the piston head on the inside, and it was to be sucked full of free air, say temperature at 60°, and forced back against a pressure of 50 pounds to the square inch, and 25 pounds to the square inch and 100 pounds to the square inch, how much of the stroke would be lost at all those pressures? What I mean is this, How far would the piston head be from the inside end of the cylinder at 50, at 25 and at 100 pounds? By answering the above you will much oblige an old subscriber.—C. H. K., Corry, Pa.

(2916) ELECTRO-BRASSING.—Please publish in your next number a formula for an electro-brassing solution, with directions for using it.—J. B., Meriden, Conn.

(2917) LIQUID GLUE.—Please give one of your subscribers a receipt for a good liquid glue.—F. A. O., Providence, R. I.

(2918) CONSUMPTION OF LAGER BEER.—Can you give me the figures of the consumption of lager-beer in the United States, and whether the same is increasing or decreasing?—T. B., Milwaukee, Wis.

(2919) TO CHECK VIOLENT EBULLITION.—In my business I require to quickly boil a liquid composition down to a thick syrup, and am greatly troubled by the violent jolting and bumping of the operation. My operations are on a small scale, and a vacuum apparatus would be too expensive for me. Can you suggest any simple remedy? If so, you will earn the thanks of an old subscriber, who has already profited greatly by your practical advice in other matters.—S. McC., Easton, Pa.

(2920) CISTERN AND FITER FOR RAIN WATER.—Please give me directions for making a good cistern and filter for saving rain water in a cellar. Is there any objection to a brick partition filter? What kind of brick is needed for the purpose?—W. N. H., Winchester, N. H.

(2921) STRENGTH OF GALVANIZED IRON.—Will you please inform one of your readers if the strength of iron plates is affected by galvanizing?—D. S. H., Trenton, N. J.

(2922) TO REMOVE CLINKER IN STOVES.—I am greatly troubled with clinker in my stove at home. It adheres so tenaciously to the fire-brick as to make it impossible to remove it by ordinary methods. Will you kindly inform me what to use to get rid of this nuisance, and oblige.—E. H., Jersey City, N. J.

(2923) TO STAIN DRIED GRASSES.—I would like to know how to prepare the bunches of grasses, etc., stained of various colors, that make such pretty parlor decorations.—M. M., New York City.

(2924) WEIGHT AND FLOTATION OF ICE.—What is the weight of one cubic foot of ice? and how much of it would be sunk below the surface when floating on water?—O. W. T., Milton, Pa.

(2925) INCRUSTATION OF BRICK WALLS.—Seeing in your December number for 1880, information in regard to the incrustation of brick walls, I should like to ask a few questions in relation thereto. What can I put on the brick to hide this unsightly appearance without changing the natural color of the bricks, and that will be permanent? Will linseed oil and some coloring that will form a filling for the pores of the bricks, prevent the discoloration? If so, please inform me. If I can stop it from coming out on the work already up, I will take your advice in the future as given in the number mentioned above. Will I get rid of this magnesian lime by purchasing the black, hard rock lime that slakes hard? I have noticed the glazed surface that is on this lime which slakes easily, such as the Harrison and Dexter limes found in Rhode Island. Is there any way by which I can detect this magnesia at first sight of the lime?—F. A. G., Providence, R. I.

(2926) RELATIVE COST OF A BUILDING OF BRICK AND ONE OF WOOD.—What would be the relative cost of a brick, frost-proof dwelling and a good building of wood?—W. N. H., Winchester, N. H.

(2927) BURNING CRUDE PETROLEUM.—I would thank you for a reference of a simple, practical method of burning crude petroleum under boilers, or in other fireplaces, such as are adapted to country places where costly iron appurtenances cannot be had.—J. H. C., Germantown, Pa.

REPLIES.

(2909) CONVERSION OF LIGHT NAPHTHAS INTO HEAVIER OILS.—No commercially successful method of converting the light oils of petroleum into heavier oils has yet been devised, although numerous and promising experiments with this object in view have been made by scientific investigators. Prof. J. Lawrence Smith, in his report on petroleum, published in Vol. III. of the Reports of the Centennial Exhibition, gives a highly interesting and lengthy account of these trials, from which we abstract the following points: One method of accomplishing the conversion of light into heavy oils, is said to be by heating the vapors of naphtha above their boiling point. S. Dana Hayes is reported to have made some experiments which tend to prove this fact by operating on oils made from naphtha distilled at a temperature below 300° Fah. These very light oils were heated in an apparatus used for a special purpose in the arts, by which the vapor of the oils was held in suspension in the vapor of water, under pressure afforded by steam over 212° Fah., but never above 300° Fah. Under these circumstances, light uncondensable gases and vapors pass upward and the heavy oil falls downward into the naphtha below; and it was found that the longer the vapors were held together in the apparatus, heated and under pressure, the more perfect were the decompositions, and from 2 to 10 per cent of heavy oil was obtained from the naphtha in different experiments. The heavy hydro-carbon oil obtained in this way is said to have had a dark yellowish-brown color, smelling of adhering naphtha when fresh, but after standing for a few days exposed to the air, it lost this odor and became nearly neutral, or comparatively free from offensive odor. Its specific gravity varied considerably on account of adhering naphtha; its boiling point was above 400° Fah. It did not evaporate at ordinary temperatures; left a permanent greasy stain on paper; proved to be a good lubricator for machinery, and when redistilled at high temperatures, it was found to break up into lighter and heavier liquid hydro-carbons, paraffine, and separated carbon. It is essentially a paraffine oil, like that of the same density obtained directly from petroleum or its heavy products by distillation. Referring to this interesting investigation by Dr. Hayes, Prof. Smith remarks that when refining petroleum for illuminating purposes, it has been desirable to break up the heavier products and convert them into the light hydro-carbons generally known in commerce as "kerosene," and several forms of distilling apparatus have been devised for this purpose, in which the vapors of these bodies, by being heated above their boiling points, are decomposed or "cracked" first into boiling oil entirely. But the apparatus and experiments of Hayes demonstrate that light petroleum naphthas, and probably distilled naphthas from coal and other sources, may be "cracked" at a temperature below 300° Fah. into lighter and heavier products, the latter being paraffine oils that belong to a class of hydro-carbons entirely different from that of the original naphtha. The above account of Dr. Hayes' investigations will suffice to show our inquirer that the conversion of the lighter oils of petroleum into heavier ones is quite feasible; whether it can be done with sufficient economy to make the operation a commercial success, is the important question. Dr. Hayes has shown that the problem is possible of solution, and has indicated the way. It remains now for our ingenious inventors to take the matter in hand and work it out commercially. The heavier oils being much more valuable than the naphthas, makes this conversion, if it can be cheaply and thoroughly effected, a most desirable one.

(2910) LAMPBLACK FROM NATURAL GAS.—The manufacture of lampblack from natural gas has been successfully carried on for seven or eight years by Mr. Peter Neff, of Gambier, O., who has utilized the gaseous product of two gas wells in Knox county, near the junction of the Kokosing and Mohican rivers in that State, and which afford abundant supplies of hydrocarbon gas for that purpose. He has devised and patented several forms of apparatus for burning the gas, which he uses in his manufacture, the most practical of which is a species of inverted burner surmounted by a hood or dome, beneath which the gas, as it issues from the burner, undergoes a smothered combustion. At the time of our latest references to this interesting industry, Mr. Neff had some 1,800 burners at work, consuming about 275,000 cubic feet of gas per 24 hours. We do not know the amount of lampblack yielded per thousand cubic feet. From all we have learned, however, the manufacture is a pronounced success. The lampblack produced by this procedure is acknowledged by all authorities to be of very superior quality, and to the best of our knowledge the process is still in successful operation. With respect to the merits of the new product, the following extract from the Reports of the Centennial Exhibition will suffice: "This lampblack is at present (1876) manufactured to the extent of about 16 tons per annum. It is very fine and smooth, free from coarse or gritty particles, and of an intense blue-black color. The absence of oily matter is very strikingly illustrated by mixing it with water. Although from the large amount of air in the mass of loose powder, most of it floats at first upon the surface; stirring soon mixes it in large quantity with the water, rendering the whole black and opaque; in this behavior it contrasts strongly with common lampblack. It does not color ether, and the liquid, when evaporated, leaves but a trace of residue, while ordinary lampblack, presumably from rosin, gives a deep yellow solution, leaving an orange-brown tar on evaporation. On burning a quantity of the diamond-black (as the new lampblack is called by its manufacturer) sufficient to fill a large platinum dish, a barely visible trace of ferruginous ash was left, derived, no doubt, from the scraping of the metallic surfaces," [of the burners in removing it.—*Ed.*] "This material is sold to makers of fine printing and lithographic inks in the United States, and has been sent in small quantities to Europe. It deserves to become more widely known." The above, we trust, will fully answer our inquirer's questions.

(2911) WATER BATH OF HIGH TEMPERATURE.—A saturated solution of either nitrate of soda, acetate of soda, carbonate of potassa, or of chloride of calcium will answer inquirer's purpose. If his object is to submit some substance to a higher temperature than that of water boiling at atmospheric pressure—that is, to a temperature of about 300° to 350° Fah., he must take the precaution to bring the material in question into *direct contact* with the boiling salt solution, or he will not accomplish his object, for it has been experimentally proved that the vapor produced at the surface of saline solutions is the steam of pure water, and that at atmospheric pressure the temperature of the steam formed is invariably 212° Fah., whatever be the nature of the dissolved salt, or of the vessel containing the solution. If the vessel containing the substance to be treated is simply suspended, as is usual, over the water bath, so as to permit the vapors arising from it to pass around it, the saline bath will not be any more effective than the common water bath. It is necessary, therefore, to place the vessel containing the material to be treated in the saline solution itself. The following table gives the boiling points of saturated solutions of various salts under atmospheric pressure. Our correspondent may make his own choice from any of these that may suit his purpose best.

	Boiling point Fah.°	*Quantity of salt to saturate 100 parts of water. Per cent.*
Chlorate of potassa	219.6	61.5
Chloride of barium	220	60.1
Carbonate of soda	220.3	48.5
Phosphate of soda	222	113.2
Chloride of potassium	227	59.4
Chloride of sodium	227.2	41.2
Neutral tartrate of potassa	238.4	296.2
Nitrate of potassa	244.2	117.5
Chloride of strontium	240.6	335.1
Nitrate of soda	250	224.8
Acetate of soda	255.8	209
Carbonate of potassa	275	205
Nitrate of lime	304	362.2
Acetate of potassa	336	798.2
Chloride of calcium	355.1	325
Nitrate of ammonia	356	Unlimited.

(2912) THE METRIC SYSTEM OF WEIGHTS AND MEASURES.—Replying to the second part of this inquiry first, we would answer that we consider the metric system of weights and measures to be as good as any that could be devised, and certainly so far superior to all other systems in use, that no comparison can be made between them. It has the great and unique merit of having a basis capable of verification by actural instrumental measurement, and it has the great advantage that it affords a simple and scientific relationship between the meter which is its basis and the unit of length, and the kilogramme and liter, which are respectively the units of weight and capacity. The metric system has been very generally adopted in Europe, but though its use is not universal, it may be said that it has become recognized by the tacit agreement of all civilized nations as affording for the future the best mode of solving the desirable problem of establishing a uniform system of weights and measures the world over. The French metric system has been adopted and its use made compulsory in the following countries: France and Belgium, in 1801; Holland, 1819; Greece, 1836; Italy and Spain, 1859; Portugal, 1860–68; the German Empire, 1872; Colombia and Venezuela, 1872; Equador, Brazil, Peru and Chili, 1860; and by the Argentine Confederation and Uraguay somewhat later. In Great Britain and Ireland, in 1864, the use of the metric system was approved, so far as to render contracts in terms of the French units permissive. In 1866, the United States legalized the French system conjointly with the old system. It is also legalized in British North America. Switzerland followed suit in 1856 by legalizing the foot of three decimeters as the standard of length with a decimal scale. Sweden, in 1858, followed with a similar action. Denmark adopted the metric system so far as to the pound of 500 grammes. Austria, in 1853, adopted the same unit with decimal subdivisions, for customs and fiscal purposes. The metric system was also lately adopted in Japan. It looks very much as though the meter, and the weights

and measures derived from it, would in time be adopted universally.

(2913) PREPARING SARDINES.—The following is a somewhat detailed, and, we believe, accurate description of the method of preparing sardines in France: The sardine being a very delicate fish, the utmost attention is directed towards having the fish as fresh as possible, and as near as can be to the factory where it is to be canned. Factories are, therefore, rarely situated more than two or three hours distance from the placewhere the fish are caught. The fish are placed on stone tables; women pluck off the heads, which operation removes the entrails. The fish are then placed on wooden slats and allowed to drip; are slightly salted, and remain over night. Next day they are again slightly salted, and allowed to dry. The old, and most approved, method of cooking sardines is to place them in vessels filled with hot oil, where they are cooked. When done, they are put into a wire basket to drip. At exactly the right point of cooking, the scales remain on the fish, which is desirable. If the cooking has been carried too far, or if the fish are too fat, the scales drop off, which impairs the value of the canned fish. A period of from five to six minutes is about the right time for the cooking in hot oil. The fish are then allowed to drip carefully, with the head part downward; when they have cooled, they are placed on tables and arranged by women in the well-known tin boxes in which they come to the market, the oil being dipped from barrels into the boxes. The oil being more valuable than the fish, efforts are made, without too much crowding, to put as many sardines in a box as possible. The lids of the boxes are then soldered, and the boxes are then heated in suitable receptacles by means of steam. The sooner this heating of the boxes takes place, the better. The temperature of the water in which the filled boxes are placed is at first cold, and the steam is gradually introduced. This second heating is sometimes carried on for an hour and a quarter. When the boxes are sufficiently heated, they are sometimes allowed to cool in the water, particular pains being taken always not to move the boxes too much. Another and cheaper method of preparing sardines is to cook them without oil in circular ovens. The after processes are the same. Sardines are most highly prized when not too large in size. Those of most approved size are worth 6 francs per thousand to the fishermen, while the larger ones only command about 4 francs. As sardines are migratory, a shoal of fish remaining at a fishing station for but a week and then going off, the largest canners of sardines have sometimes two factories, situated at different localities on the coast. The fishing and canning season occupies about three months, from the middle of May to the middle of August. During the other months the sardine factories engage in the preparation of other food products.

(2914) RITCHIE MINERAL.—The name Ritchie Mineral is attached to an asphaltum-like substance found in Ritchie county, West Va. It is an exceedingly curious deposit from a mineralogical standpoint, consisting as it does of a vertical seam of solid asphaltum, cutting the horizontal coal measures of that district, and has been traced for a length of over 1,000 yards. The asphaltum is pure and clear; it fills up a gash or chasm in the horizontal layers, the walls of which consist of a yellowish sandstone. With respect to its origin, Prof. Lesley, the eminent geologist, supposes that it may represent the consolidated portion of petroleum, which came from a reservoir that may still exist below this asphaltum. The depth of this crevice is unknown, and at a greater depth than it has yet been explored it may grow wider; but there seems to be little doubt that the mineral has for its source some immense subterranean lake or large opening into the lower measures of liquid petroleum, for numerous gas and oil springs in the neighborhood of this asphaltum dyke give evidence of the abundance of petroleum beneath the surface.

(2915) PUMP PROBLEM.—The rule to be followed in arriving at the answer to this question, is that the volume of a gas like the air is inversely proportional to the pressure. Thus designating by V the volume of the air drawn into the pump, and calling this volume 1, and designating its pressure, which equals that of the atmosphere (or approximately 15 pounds per square inch), by P, and calling the volume formed by changes of pressure, V^1, and these different pressures by P^1, then the formula for this relation would be:

$$V : V^1 :: P^1 : P; \text{ or, } V^1 = \frac{PV}{P^1}$$

Taking the first question, of pumping out against 50 pounds pressure, we should have

$$V^1 = \frac{15\times 1}{50} = \frac{3}{10}\text{ths}$$

the value of V^1; where $P^1 = 25$ would be six-10ths; and where $P^1 = 100$, V^1 would equal fifteen-100ths. That is to say, to force the air out of his pump against 50 pounds pressure, the volume of the air must be compressed to three-10ths of what it was originally, and the piston would therefore lose seven-10ths of its stroke; to pump against 25 pounds, the volume of the air would have to be compressed to six-10ths of what it was, and the piston would lose four-10ths of its stroke; to pump against 100 pounds, the volume would have to be reduced to fifteen-100ths of what it was, and the piston would lose eighty-five-100ths of its stroke. Supposing the piston to be at the top of the cylinder, it would then be 7 inches from the top at 50 pounds, 4 inches from the top at 25 pounds, and 8½ inches from the top at 100 pounds.

(2916) ELECTRO-BRASSING.—The following formula for a brassing solution is highly recommended:

Acetate of copper	5	ounces.
Potassa	4½	pounds.
Sulphate of zinc	10	ounces.
Aqua ammonia	1	quart.
Cyanide of potassium	8	ounces.

The above solution is to be prepared as follows: Dissolve the acetate of copper, which should be previously pulverized, in ½ gallon of water; add 1 pint of the liquid ammonia, and then dissolve the sulphate of zinc in 1 gallon of water, the temperature of which should be raised to about 180° Fah. When the zinc salt is dissolved, add the remaining pint of liquid ammonia to the solution, which should be stirred at the time, to insure its perfect mixture with the zinc. Dissolve the potash in 1 gallon of water. Lastly dissolve the cyanide of potassium in 1 gallon of water, and then mix the ingredients in the following order: Add the solution of copper to that of the zinc, then add the solution of potash and cyanide. Stir the whole well together, and digest for about an hour, with occasional stirring. Finally, add enough water to make 8 gallons of solution. It is recommended that the above solution be worked with active battery power and a brass anode. A little liquid ammonia may be added from time to time, and also a small quantity of cyanide of potassium, when the bath works slowly. The anode should be kept clean. Mr. Alexander Watt, a well-known writer on the subject of electro-metallurgy, in speaking of this bath, remarks that the addition of a little arsenious acid to it, improves the character of the deposit by making it brighter and less crystalline. The advantage of this addition does not at first appear, but becomes quite decided after the bath has been for some time in operation. The preferable mode of adding the arsenic is to mix it with a strong solution of cyanide of potassium. The addition of about an ounce of the above solution will be sufficient at first, and further additions may be made from time to time. A second formula, also highly spoken of, is the following:

Cyanide of potassium	12 parts.
Carbonate of potassium	610 "
Sulphate of zinc	48 "
Chloride of copper	25 "
Nitrate of ammonia	305 "
Water	5,000 "

Dissolve the cyanide of potassium in 120 parts of the above quantity of water, and then dissolve the carbonate of potassium, sulphate of zinc and chloride of copper in the remaining water, raising the temperature to about 150° Fah. As soon as the salts are well dissolved, add the nitrate of ammonia, stirring the solution during the addition. This solution should be allowed to stand for a few days after making, in order to allow of the settlement of any precipitate, when the clear liquor may be decanted from the latter, and is ready for use. To use electro-brassing solutions with uniform success requires careful attention to the preparation of the bath and to the power of the battery employed, which latter should be regulated by the surface of the goods to be covered. The amount of anode should also be regulated by the surface to be coated. If the proper conditions are not carefully observed, the results will be uncertain, or either, the copper alone or the zinc alone will be deposited. The care and attention required for electro-brassing have caused this useful art to fall into unmerited neglect.

(2917) LIQUID GLUE.—The following receipts may answer our inquirer's purpose: Take a wide-mouthed vessel and dissolve in it 8 ounces of best glue in ½ pint of water, by placing it in a vessel of water and heating until dissolved. Then add slowly 2½ ounces of strong *aqua fortis* (nitric acid) 36° Beaumur, stirring all the while. Effervescence takes place attended with the liberation of nitrous fumes. After the acid has all been added, the liquid is allowed to cool. It should be kept in well-stoppered bottles, and is ready for use at any time. This preparation will not gelatinize, nor undergo putrefaction or fermentation, and makes a strong joint. Another receipt recommends: Best white glue, 16 ounces; white lead (dry), 4 ounces; rain water, 1 quart; alcohol, 4 ounces. Make a thin fluid mixture of the glue and lead in the water on the water-bath, add the alcohol, and continue the heat for a few minutes. Then pour the liquid into bottles (previously warmed) while it is still hot. This is said to give an excellent liquid glue. Another receipt directs as follows: Soften 3 parts of glue in 8 parts of water (by weight), then add ½ part muriatic acid, and ¾ parts of sulphate of zinc, and heat the mixture 185° Fah. for ten or twelve hours. The mixture remains liquid after cooling, and is said to be useful as a cement for a variety of uses.

(2918) CONSUMPTION OF LAGER BEER.—From a late article in the *Brewers' Journal*, of Philadelphia, we glean the following relating to the manufacture and consumption of lager beer in this country: About 200 new breweries were established in the United States during the year ended May 1, 1881. In 1877, the sale of beer in this country amounted to 9,752,030 barrels; for the year 1880, the sales were 12,800,900, and for 1881, 14,125,466. The increase of sales of the year ending May 1, 1881, over the preceding year, was 1,324,566 barrels, and over 1877, 4,373,436 barrels. From the above it would appear that the brewing industry is in a highly flourishing condition, and that the consumption of the beverage is steadily on the increase. The total number of breweries in the country, according to the same authority, is placed at about 3,000, and the brewery turning out the largest product—350,000 barrels—is that of the Philip Best Brewing Co., of our inquirer's own city.

(2919) TO CHECK VIOLENT EBULLITION.—The trouble complained of by this inquirer is a common one. It is caused principally by the increasing cohesiveness between the particles of the syrupy mass and its increased adhesion to the walls of the containing vessel. The means usually adopted to prevent such trouble is constant agitation of the syrup by stirring, to prevent its adhesion to the walls of the vessel, and also the introduction of a number of angular fragments of stone into the vessel. The sharp edges and corners of these fragments afford surfaces from which the steam and vapor of the liquid can readily escape, and their presence will no doubt greatly lessen the violence of the ebullition in the case here referred to.

(2920) CISTERN AND FILTER FOR RAIN WATER.—The usual practice with experienced builders is to build the walls of the cistern of good hard brick laid in cement, and subsequently to cover the interior with a good layer of cement. There is no objection that we know of to a brick partition filter. The brick used for the purpose must, of course, be sufficiently porous to permit of free infiltration through them. What is known as a good quality of salmon brick, would no doubt answer the purpose very well. Should this inquirer wish it, we can send him, at his cost, per express, a sample of the kind of brick commonly used for this purpose. The partition is sometimes built in the form of an arch at the bottom of the cistern, with the pump tube projecting through it, and at other times at the side of the cistern.

(2921) STRENGTH OF GALVANIZED IRON.—The strength of iron plates is not appreciably affected either favorably or unfavorably by galvanizing. The only experiments we can refer to on this subject, at the time of this writing, are from English sources, and they confirm the opinion above expressed. Fourteen specimens of Glasgow best boiler plate, from three-16ths to three-8ths of an inch thick, were prepared for trial. One half of these were left black and the other half were galvanized. They were afterwards tested, and there was no perceptible difference in any respect between the galvanized and the ungalvanized specimens.

(2922) TO REMOVE CLINKER IN STOVES.—The coal is to blame for the formation of clinker. The constituents of the ash of certain coals, and sometimes the stony impurities from which the coal has not been carefully freed, will, when the fire is very intense, fuse down more or less completely, and form the mass known as clinker, which becomes especially troublesome when it attaches itself to the fire-brick lining of the fire-space, from which it can only be removed by the use of the hammer; and unless very carefully performed, this operation is likely to fracture the bricks. The only way to avoid the annoyance of clinker, is to dispense in future with a coal that is known to form it.

(2923) TO STAIN DRIED GRASSES.—Bunches of dried grasses can readily be dyed of a great variety of tints by dipping them into an alcoholic solution of the various aniline colors. Some of these have a beautiful rose shade, others red, blue, orange, purple, etc. The depth of color can be regulated by diluting the dyeing solution with water or diluted spirits. When taken out of the dye, the grasses should be exposed to the air to dry off the spirit. Then they are ready to be arranged into bunches or bouquets, but not until they are quite dry. The pink saucers sold by most druggists contain enough rose dye for two ordinary bouquets. The best way to use it is to wash it off with water and lemon juice.

(2924) WEIGHT AND FLOTATION OF ICE.—The specific gravity of ice is estimated by the best authorities to be .9175, water being equal to 1. As the weight of a cubic foot of water equals almost exactly 62⅓ pounds, a cubic foot of ice would weigh, therefore, (62⅓ × .9175), or almost exactly 57⅕ pounds. As a floating body displaces a weight of the liquid equal to its own weight, it follows that a cubic foot of ice floating on water must displace 57⅕ pounds of water, or about eleven-12ths of a cubic foot. A cubic foot of ice, therefore, floating on water, would have eleven-12ths of its volume under water, and only one-12th above the surface.

(2925) INCRUSTATION OF BRICK WALLS.—This inquirer will find his questions answered partially in answers Nos. 2900 and 2901, given in our issue for November. We may add thereto that we would not recommend any treatment of the bricks short of painting with usual brick color mixed in oil, and penciling the joints. This remedy will answer the purpose of keeping the incrustation away quite satisfactorily. We gave in our last number a few practical rules by which magnesian lime mortars could be detected. We are not aware of the character of the limes which our inquirer names, and cannot therefore advise him if they are pure or magnesian.

(2926) RELATIVE COST OF A BUILDING OF BRICK AND ONE OF WOOD.—As to the relative cost of a brick, frost-proof dwelling and one of wood, the question is very vague; but answering in a general way, we should say that the former would cost approximately one and a half to twice as much as the latter, dimensions and other details of interior being the same in both cases.

(2927) BURNING CRUDE PETROLEUM.—There are no works on the subject of burning petroleum, and the references to the methods proposed are scattered through the pages of the technical journals for the past ten years. We can only refer this correspondent to the files of the leading scientific journals and the records of the foreign and American Patent Offices from which to glean the information he desires.